Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 336

Contribution from the Bureau of Plant Industry
WM. A. TAYLOR, Chief

Washington, D. C. ▼ February 10, 1916

CEREAL EXPERIMENTS IN MARYLAND AND VIRGINIA.

By T. R. STANTON, *Scientific Assistant, Office of Cereal Investigations.*

CONTENTS.

	Page.		Page.
Introduction	1	Experiments with winter spelt and emmer	26
Cereal production in Maryland and Virginia	2	Experiments with winter rye	30
Physical factors	3	Experiments with winter oats	34
Nature of the experiments	6	Experiments with winter barley	42
Conditions of the plat experiments	7	Experiments with spring-sown grains	49
Experiments with winter wheat	9	Summary	49

INTRODUCTION.

Experiments with cereals have been conducted cooperatively since 1904 at College Park, Md., by the Maryland Agricultural Experiment Station and the Office of Cereal Investigations.[1] Similar experiments have been conducted by the Office of Cereal Investigations on the Arlington Farm, Rosslyn, Va., since 1907.[2] These experiments have consisted mainly of varietal tests and extensive breeding operations with the most important winter cereals. This bulletin is for the most part a report of the varietal tests. The varietal testing has

[1] The preliminary cereal work conducted at College Park, Md., prior to 1907 was under the supervision of Mr. Mark Alfred Carleton, Cerealist of the Bureau of Plant Industry. Mr. H. A. Miller, a scientific assistant in the Office of Cereal Investigations, was in immediate charge. On October 1, 1907, when cooperative cereal investigations were begun with the Maryland station, Mr. V. M. Shoesmith, then agronomist at the station, was made collaborator. From the time of Mr. Shoesmith's resignation on January 1, 1908, Mr. C. W. Nash, assistant agronomist at the station, acted as collaborator to September 1, 1909. On the latter date Mr. N. Schmitz was appointed agronomist of the Maryland station, since which time he has been collaborator.

[2] The Arlington Farm is located in Virginia on the southern bank of the Potomac River, just opposite and to the west of the city of Washington, D. C. The experimental work with cereals has been under the direction of the men in charge of wheat, oat, and barley investigations in the Office of Cereal Investigations. From 1907 to 1912 Mr. H. B. Derr supervised the work with barley and wheat at the Arlington Farm. Since that time the work with these cereals has been in charge of Drs. H. V. Harlan and C. E. Leighty, respectively. Mr. C. W. Warburton has been in charge of the work with oats during practically the entire period. During the summer of 1908 Mr. T. B. Mackall assisted with the work at Arlington Farm; in the summers of 1909 and 1910 Mr. O. H. Saunders rendered similar service. The writer was appointed agent in the Office of Cereal Investigations on April 17, 1911, and scientific assistant in the same office on May 17, 1912. He has had direct charge of the work at Arlington Farm since the former date.

been confined largely to winter wheat, oats, and barley, although tests of several minor cereals, including winter rye, spelt, and emmer also have been conducted. In addition, some investigations have been conducted on the Arlington Farm with grain sorghum, buckwheat, proso, and spring varieties of wheat, oats, and barley. A preliminary report covering a portion of the cooperative cereal investigations at College Park was published in 1910.[1] In this bulletin a complete presentation of the work at College Park and at Arlington is made and such conclusions drawn as the results appear to warrant.

CEREAL PRODUCTION IN MARYLAND AND VIRGINIA.

The early history of the cultivation and production of cereal crops in Maryland and Virginia is quite meager, but it is known that their culture went hand in hand with the settlement of these colonies. In the report of the United States Commissioner of Agriculture for the year 1872,[2] the following statements are made regarding the early history of the culture of cereals in the thirteen original States:

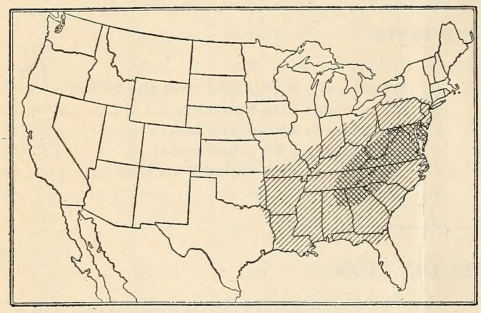

FIG. 1.—Sketch map showing the areas in the eastern United States to which this bulletin applies. In the heavily shaded portion the results are generally applicable. Certain of the results are applicable in some parts of the lightly shaded portion, while other results are applicable in other parts.

> Wheat was first sown by Goswold on Cuttyhunk, one of the Elizabeth Islands, in Buzzard's Bay, as early as 1602, when he first explored the coast. In Virginia the first wheat appears to have been sown in 1611, and its culture continued to increase there till, in 1648, it is recorded that there were several hundred acres of it. But it soon after fell into great disrepute as a staple crop, as the culture of tobacco was found to pay a great deal better. For more than a hundred years after it was but little cultivated in that colony.
>
> But though the cultivation of wheat was begun almost simultaneously with the settlement of the several colonies, it did not attract very great attention for more than a century, Indian corn and, later, potatoes being relied upon for food to a much greater extent. . . . It is a matter of history that there never was a time in the eastern colonies when it was a sure and reliable crop, unless it be so now with our improved modes of culture and our better knowledge of the proper modes of tillage, deep plowing, and thorough drainage.
>
> Rye and barley were also introduced and cultivated by the early settlers, and it soon became the almost universal practice to mix the meal of the former with Indian meal in the making of bread. It is known to have been the custom as early as 1648, and probably it began at a considerably earlier date, perhaps as early as 1630. Oats were also introduced at the same time with rye. Capt. Goswold raised them with other grains on one of the Elizabeth Islands, on the southern coast of Massachusetts, in 1602. Though much more extensively grown than rye, they appear to have been used chiefly as food for animals.

[1] Schmitz, Nickolas. Wheat—variety tests and diseases. Md. Agr. Exp. Sta. Bul. 147, p. 33–45. 1910.

[2] Flint, C. L. A hundred years of progress. *In* U. S. Com. Agr. Rpt., 1872, p. 280. 1874.

While it is known that these crops were grown in Virginia and Maryland since early colonial days, they did not come into prominence until the last half of the nineteenth century, when the invention of the thrashing machine and the self-binder greatly stimulated their production. To-day Virginia and Maryland are not great grain-producing sections as compared with the North-Central States, yet wheat, oats, barley, and rye are grown to a greater or lesser extent throughout these and adjoining States. Of the small grains, winter wheat has always been foremost in importance; in fact, its annual production is many times greater than that of all others combined.

During the 10-year period from 1905 to 1914, inclusive, the acreage and production of wheat in Maryland and Virginia have remained about stationary. The average production for the former State has been about 11,000,000 bushels, and for the latter about 9,000,000 bushels. The acreage in wheat in the two States, however, has been about the same. The fact that the average yield per acre for Virginia has been only slightly more than 12 bushels, as compared with about 16.5 bushels for Maryland, accounts for the greater production in the latter State.

During the same period the relative importance of oats, rye, and barley has been in the order named. Rye is grown entirely as a fall-sown crop, while oats and barley are grown from both spring and fall seeding.

PHYSICAL FACTORS.

Information with regard to the physical factors which may influence crop experiments is desirable for the interpretation of results. For that reason data are given on the soil and climatic conditions at College Park and at Arlington Farm.

SOILS.

The soil of that particular portion of the Maryland Agricultural Experiment Station farm on which the experiments here reported were conducted is classed by the United States Bureau of Soils as Sassafras sandy loam. It is a medium to fine brown sandy loam of sedimentary origin, with an average depth of about 10 inches. The subsoil consists of a slightly sandy or rather heavy yellow loam, usually 5 or more feet in depth. The subsoil is more retentive of water than is usual in this type of soil, so that this section is for the most part poorly drained. This general soil type is not difficult to cultivate and responds well to good treatment. It is well suited to grain growing.

The soil of the Arlington Farm consists of a very heavy clay loam, yellow to brown in color, ranging from 4 to 10 inches in depth. It is underlain by a stiff, plastic, red, gray, or purplish clay subsoil of

variable depth. It is known locally as brick clay. The general soil type in its natural condition is difficult to cultivate. The extensive and continued use of green-manuring crops, commercial fertilizers, and lime, with the installation of a complete system of tile drainage, has greatly improved its physical condition as well as eliminated to a large degree the lack of uniformity in productiveness. The texture has been improved, thus rendering it easier to cultivate and more congenial to plant growth. This soil probably would be classed as Susquehanna clay, a type that usually is not well adapted to grain growing.

CLIMATIC CONDITIONS.

Rainfall in the eastern half of the United States is not usually an important limiting factor in crop production. Other general physical phenomena, such as wind and evaporation, also are not of great importance; consequently they are not used so much as an index to crop production as in the semiarid areas. Soil fertility is one of the most important factors in crop production throughout all the older agricultural regions in the eastern United States.

The most serious climatic condition encountered in the experimental work with cereals at College Park and Arlington has been the occurrence of hot, humid, showery weather during the ripening period, causing the rapid development of rust, scab, and other diseases. This has been more particularly true with reference to winter wheat, as winter oats and barley usually escape because of earlier maturity. In some years short periods of drought undoubtedly affect these crops, but in general they are not of serious consequence.

In the pages which follow, data are given on the rainfall and temperature for the period from 1905 to 1914. These data were recorded at the Weather Bureau station in Washington, D. C., about 10 miles west of College Park and about 2 miles north of the Arlington Farm.

RAINFALL.

The annual and average precipitation by months at Washington, D. C., for the 10 crop years from July, 1904, to June, 1914, inclusive, are shown in Table I. Weather data are now recorded at Arlington Farm, but as these data are available only since October, 1910, it was deemed advisable to use the data in full from the Weather Bureau station in Washington.

The average annual precipitation at Washington for the 10 crop years from July, 1904, to June, 1914, inclusive, as shown in Table I, was 42.33 inches. For this period the maximum annual precipitation was 53.47 inches (1906–7), and the minimum, 33.22 inches (1910–11).

Table I shows that August is usually the wettest month, while November is the driest. The average annual precipitation at College

Park is about 4 inches less than at Washington. Considerable variation in the monthly distribution at the two points also occurs.

TABLE I.—*Monthly and average precipitation at Washington, D. C., for the ten 12-month periods (crop years) from July, 1904, to June, 1914, inclusive, with the total and monthly average for each period.*

[Data (in inches) from the records of the United States Weather Bureau.]

Month.	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	Average.
July	6.25	9.95	6.80	1.55	3.29	1.80	3.73	4.47	7.21	3.24	4.83
August	2.97	9.75	14.36	4.34	5.14	2.27	1.26	7.27	1.50	5.42	5.43
September	5.34	2.34	.60	7.15	4.65	3.42	2.15	2.03	5.86	2.41	3.60
October	2.35	2.30	5.71	2.12	1.71	.79	5.74	4.07	.65	3.37	2.88
November	2.20	1.03	1.63	4.16	.60	.89	2.28	3.85	1.54	2.20	2.04
December	3.33	5.39	3.23	4.20	3.63	3.39	2.64	3.34	4.12	2.29	3.56
	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	
January	3.59	3.11	2.54	3.45	2.84	4.39	2.92	2.82	2.85	4.60	3.31
February	2.55	2.14	2.31	3.98	3.11	2.20	1.92	2.70	1.37	3.05	2.53
March	3.31	4.62	2.79	2.45	4.76	.57	2.31	6.14	4.67	2.27	3.39
April	2.69	3.03	3.61	1.60	2.69	5.89	2.85	2.33	5.86	3.20	3.38
May	3.22	1.80	5.03	6.10	3.77	3.43	.87	4.84	4.55	1.72	3.53
June	4.52	5.89	4.86	1.73	3.82	4.77	4.55	4.36	1.81	2.32	3.86
Total	42.32	51.35	53.47	42.83	40.01	33.81	33.22	48.22	41.99	36.09	42.33

TEMPERATURE.

A summary of the mean, maximum, and minimum temperatures for the 10 crop years from July, 1904, to June, 1914, inclusive, at Washington, D. C., is presented in Table II.

TABLE II.—*Annual and average mean, maximum, and minimum temperatures, by months, at Washington, D. C., for the ten 12-month periods (crop years) from July, 1904, to June, 1914, inclusive, with the annual mean and absolute maximum for each crop year.*

[Data (in °F.) from the records of the United States Weather Bureau.]

Month.	1904			1905			1906			1907			1908		
	Mean.	Max.	Min.	Mean.	Max.	Min.	Mean.	Max.	Min.	Mean.	Max.	Min.	Mean.	Max.	Min.
July	74.4	92	57	76.4	95	60	75.2	91	56	75.8	93	52	78.0	99	57
August	72.3	92	52	73.6	90	52	76.4	94	62	72 4	91	55	73.2	95	52
September	67.4	90	36	68.2	88	41	72.9	94	50	69.4	91	43	66.6	86	41
October	54.1	86	28	56.9	88	33	56.9	82	31	52.0	81	30	58.2	86	34
November	43.1	68	25	44.4	73	20	47.8	75	30	44.5	65	24	46.0	72	19
December	30.9	60	6	37.5	59	18	37.0	69	13	38.1	68	19	37.0	69	18
	1905			1906			1907			1908			1909		
January	29.8	65	−2	40.0	71	11	37.2	76	10	34.2	58	11	36.0	61	13
February	26.4	49	4	34.0	64	7	30.2	58	3	30.8	67	6	43.0	70	17
March	45.0	80	14	37.6	62	18	48.8	93	22	47.4	80	25	42.1	75	26
April	54.0	82	29	55.5	87	27	48.4	83	23	56.4	87	29	54.2	88	26
May	65.2	87	41	64.4	92	33	59.2	85	39	65.3	92	39	64.4	90	36
June	71.8	93	47	72.8	95	53	65.9	89	48	71.8	97	52	73.4	94	51
Annual:															
Mean	52.9	....	....	55.1	....	....	54.7	....	....	54.8	....	....	56.0	....	....
Maximum	.....	93	....	.....	95	....	.....	94	....	.....	97	....	.....	99	....
Minimum	.....	....	−2	.....	....	7	.....	....	3	.....	....	6	.....	....	13

TABLE II.—*Annual and average mean, maximum, and minimum temperatures, by months, at Washington, D. C.*—Continued.

Month.	1909			1910			1911			1912			1913			Average.		
	Mean.	Max.	Min.	Mean.	Max.	Min.	Mean.	Max.	Min.	Mean.	Max.	Min.	Mean.	Max.	Min.	Mean.	Max.	Min.
July	74.7	96	53	77.6	95	57	78.7	99	56	75.8	94	60	77.6	97	58	76.4	95.1	56.6
August	73.0	96	53	73.8	90	58	76.6	100	54	73.4	92	53	74.2	97	54	73.9	93.7	54.5
September	66.4	84	42	71.0	94	48	70.4	89	46	70.4	94	42	67.4	93	40	69.0	90.3	42.9
October	53.1	80	31	60.2	90	31	57.2	80	38	59.3	87	36	58.8	77	35	56.7	83.7	32.7
November	50.8	77	29	41.4	66	23	42.8	70	22	46.9	77	25	47.8	76	28	45.6	71.9	24.5
December	31.8	66	8	30.5	62	8	41.0	67	22	40.0	73	19	40.4	66	24	36.4	65.9	15.5
	1910			1911			1912			1913			1914					
January	33.7	58	11	38.2	68	15	25.0	58	−13	43.6	68	24	38.6	72	7	35.6	65.5	8.7
February	34.7	68	8	37.0	68	21	31.0	56	7	36.4	68	13	30.1	59	−1	33.4	62.7	8.5
March	51.2	86	26	41.0	75	14	40.9	76	18	49.0	77	17	29.4	75	15	43.2	77.9	19.5
April	57.9	92	37	51.2	80	26	55.6	81	31	55.4	86	32	53.5	86	28	54.2	85.2	28.8
May	61.5	87	39	70.0	96	37	65.1	90	41	64.4	90	37	67.0	95	41	64.7	90.4	38.3
June	69.7	94	45	73.0	101	56	70.4	93	45	72.8	96	45	75.9	98	56	71.8	95.0	49.8
Annual:																		
Mean	54.9	....	....	55.4	....	....	54.6	....	....	57.3	....	....	55.1	....	....	55.1	....	....
Maximum	.....	96	....	.....	101	....	.....	100	....	.....	96	....	.....	98	....	.....	.....	....
Minimum	.....	....	8	.....	....	8	.....	....	−13	.....	....	13	.....	....	−1	.....	.....	....

Table II shows that the highest average mean temperatures have been recorded in July and the lowest average means in February. The average mean temperature for the 10 crop years was 55.1° F. The variation from this average has been slight, the warmest crop year having an annual mean of 57.3° and the coolest 52.9°. During the 10 years the absolute maximum has exceeded 100° F. only once, and the absolute minimum has fallen below zero in only three years. The lowest temperature recorded during the period was in January, 1912, −13° F. The annual mean temperatures at College Park are almost invariably 1 degree lower than at Washington.

NATURE OF THE EXPERIMENTS.

The primary object in all the varietal tests at College Park and Arlington Farm has been to determine the relative yielding power of the different varieties. Attempts have been made also to improve the yield, quality of grain, and other important characters in some of the leading varieties by both mass and pure-line selection. The production of new varieties by hybridization also has been attempted. The work done along these latter lines has been too extensive to permit presentation within the limits of this bulletin.

Nursery experiments in which each variety is grown in short rows of uniform length, row space, and rate of seeding are also conducted, in addition to the regular varietal tests in field plats. The usual procedure has been that if a new variety is especially promising in the nursery it is advanced to the field-plat tests as soon as sufficient seed

is available. If a variety fails to give evidence of superior merit or adaptability after repeated trials in nursery rows, it is usually discarded, although sometimes it is retained for some character that may be of value for breeding purposes.

Many hundreds of varieties and strains from various sources have been tested in the nursery. These have included importations from many foreign countries, new and untried sorts, and numerous local varieties. After several trials in nursery rows most of them have failed to warrant more extensive tests. Only a small proportion has been grown in the plats.

The plat tests at College Park have included 107 varieties and strains of winter wheat, 13 of winter oats, 12 of winter barley, and several each of winter spelt and emmer. At Arlington Farm they have included 43 varieties and strains of winter wheat, 19 of winter oats, 56 of winter barley, 12 of winter rye, and 6 of winter spelt and emmer. A rate-of-seeding test with wheat has also been conducted at Arlington. With some of these cereals the varietal trials have not been of sufficient duration to be conclusive. With others some very reliable results have been obtained. In general, those varieties that were discarded, more especially those that were grown only two or three years, were mixtures of some of the varieties already in the tests or were decidedly inferior in some character or characters.

During the period of crop growth, rather complete notes are taken on the different varieties. The date of seeding, rate of seeding, date of emergence, and stand usually constitute the data recorded in the autumn. In the spring the winter survival (estimated), dates of heading, ripening, and harvesting, the percentage of smut and rust infection and of lodging, and the average height of plants are recorded. At harvest time samples of the heads and of the whole plants are taken and stored for reference and study.

A small separator, especially designed for the purpose, is used in thrashing. The total weight of the crop is obtained just before thrashing, and the weight of the thrashed grain immediately thereafter. After thrashing, the grain is fanned and the weight per bushel determined. The yield per acre in bushels is figured at the standard weight per bushel for each crop.

CONDITIONS OF THE PLAT EXPERIMENTS.

DIMENSIONS.

At College Park the varietal tests have been conducted almost exclusively on twentieth-acre plats (10½ feet by 208 feet). They lie in series running north and south, with 18-inch alleys between the plats in the series. The roadways dividing the series (or fields, as they are called at the Maryland station) are 16½ feet in width.

At Arlington also most of the field tests have been conducted on twentieth-acre plats (16½ feet by 132 feet). During the earlier years of the work tenth-acre plats (33 feet by 132 feet), and also a few fortieth-acre plats (8¼ feet by 132 feet), were used. These plats also lie in series running north and south, with 18-inch alleys between the plats within the series. The series are separated by roadways 19⅘ feet in width.

TREATMENT AND CROPPING OF PLATS.

The cereal experiments at Arlington Farm have been conducted on land that is undergoing a system of soil renovation by the use of green-manure crops, stable manure, commercial fertilizers, and lime. Sufficient acreage has been available to allow the alternation of the cereals with other crops. By this method the mixing of varieties from volunteer plants is avoided, and there is opportunity to carry out the general scheme of soil improvement. In general, the cereals have followed crops of cowpeas or soy beans plowed under in late August or early September. This is usually the third green-manure crop to be plowed under during the 15 months that elapse between the two grain crops, as the latter are always immediately followed as well as preceded by cowpeas or soy beans with a crop of winter rye between the two legume crops.

In addition, a top-dressing of about 10 tons of stable manure per acre is applied to the rye during the winter. At seeding time 200 pounds of acid phosphate, containing about 14 per cent of phosphoric acid, are applied.

Immediately after plowing the plats are worked down with the disk and acme harrows and allowed to remain until seeding time, when a good seed bed is usually obtained by double disking and harrowing.

The seeding is done with an 8-foot single-disk drill. The disks are 8 inches apart, with no chains or other leveling or compacting device attached. After seeding, the plats receive no further treatment, except that just prior to harvesting they are rogued in order to keep the varieties as free as possible from mixtures. The harvesting is done with an ordinary grain binder. The bundles are shocked, placing from 12 to 14 in a shock, and are allowed to stand in the field until stored or thrashed. The grain in the shock usually is protected from birds and the weather by canvas shock covers.

The small-grain crops at College Park are included in a more or less definite rotation, in which no hay or grass crop is used. The scheme has been to grow corn two years, followed by wheat or other small grains two years, with supplementary crops of crimson clover and cowpeas for green-manuring purposes.

Manure and commercial fertilizers also are used to maintain the soil fertility. The former is used on the corn crop, while the latter

always is applied to the small-grain crop. At seeding time from 300 to 400 pounds per acre of the following mixture are applied:

	Pounds.
Acid phosphate (14 per cent)	1,400
Muriate of potash	200
Tankage	300
Nitrate of soda	100

This fertilizer analyzes approximately 9 to 10 per cent phosphoric acid, 5 per cent potash, and 2 per cent nitrogen. It is applied just before seeding by drilling it across the plats. By this method a more nearly even distribution of the fertilizer is secured, thus greatly reducing the chances of experimental error.

The plats are prepared for seeding in much the same manner as those at Arlington Farm. The seeding, harvesting, and thrashing operations also are quite similar. A hoe drill having 9 hoes 7 inches apart is used in seeding the plats.

EXPERIMENTS WITH WINTER WHEAT.

VARIETAL TESTS.

The varietal tests of wheat conducted at College Park and Arlington Farm have been confined entirely to winter varieties. Since winter wheat is by far the most important and widely grown small-grain crop in Maryland and Virginia, naturally it has received the most attention in these experiments. It is well known that spring wheat can not be grown successfully in the Middle Atlantic States. Attempts to grow it have been made by experimenters and by farmers, but never with any real success.

DATA ON YIELDS.

The annual and average yields per acre, in bushels of 60 pounds, for the varieties tested at College Park from 1908 to 1914, inclusive, and at Arlington from 1910 to 1914, inclusive, are presented in Table III. A few varieties were grown in field plats at Arlington in 1909, but the results were very unsatisfactory, because of nonuniform soil conditions and injury by birds. It was deemed best therefore not to include them in the table, as they are not at all comparable to those obtained in succeeding years.

The varieties shown in Table III have been sown at the rate of 6 pecks per acre each year except in 1908 and 1909, when rates of 5 and 6½ pecks, respectively, were used at College Park. The date of seeding also has been quite uniform, ranging from October 5 to 15. At each point all the varieties usually are sown within a period of two or three days each year.

The 82 varieties and strains shown in the Maryland section of the table have been grown for periods of 2 to 7 years at College Park. In the fall of 1908, after one year's results had been obtained, 25

varieties were discontinued.[1] These do not appear in Table III. During the following years 40 additional varieties were discontinued and 20 new ones added.

TABLE III.—*Annual and average yields of varieties of winter wheat grown at the Maryland Agricultural Experiment Station (College Park) and at Arlington Farm, Va., for the years stated.*

COLLEGE PARK (82 VARIETIES).

Group and variety.	C. I. No.[2]	Maryland station No.	Yield per acre (bushels).							
			1908	1909	1910	1911	1912	1913	1914	Average.
SOFT RED WINTER.										
Awned, glumes glabrous, white:										
Mammoth Red	2008	.....	37.36	27.23	26.77	37.67	23.37	28.33	36.93	31.09
Bearded Purple Straw	1911	.....	32.93	27.13	29.17	39.87	24.13	24.67	38.77	30.95
Turkish Amber	.....	195	33.10	25.67	29.83	34.80	24.53	23.43	39.43	30.11
Lancaster[3]	1945	.....	37.88	24.57	27.27	35.90	25.40	24.37	34.83	30.03
Dietz (Dietz Longberry)	1981	.....	25.07	28.87	28.27	39.80	23.40	22.10	38.63	29.53
Dietz	.....	95	27.33	26.37	26.30	40.23	22.23	24.73	33.07	28.71
Gipsy	.....	199	34.23	19.57	32.57	38.43	17.93	24.17	29.37	28.04
Fishhead	1732	.....	27.60	20.83	28.57	36.53	21.67	21.57	39.00	27.97
Valley	.....	92	26.93	20.30	31.50	26.53	21.33	24.63	35.17	26.63
Reliable	.....	189	27.40	16.73	27.67	27.17	19.30	22.40	30.53	24.46
Silver Sheaf (Jones Silver Sheaf Longberry)	2496	.....	36.97	17.17	28.47	25.73	16.17	9.93	28.00	23.21
Doub	.....	348	.....	.....	29.00	27.60	28.93	17.67	27.00	26.04
Rudy	.....	349	.....	.....	22.60	26.70	25.97	19.07	35.73	26.01
Fulcaster	.....	352	.....	.....	.....	29.20	19.90	27.40	36.87	28.34
Fulcaster (Acme)	.....	354	.....	.....	.....	30.17	29.20	15.73	35.13	27.56
Stoner (Miracle)	.....	358	.....	.....	.....	.....	27.87	16.20	32.33	25.47
Diamond Grit	1941	.....	36.97	17.60	28.00	29.77	8.77	.....	.....	24.22
Servia	1673	.....	36.46	16.93	29.47	.....	.....	.....	.....	27.62
Tuscan Island	1984	.....	35.69	22.20	27.47	.....	.....	.....	.....	27.45
Budapest	1739	.....	36.59	15.10	29.00	.....	.....	.....	.....	26.90
Missouri Bluestem[4]	1910	.....	32.10	14.27	26.87	.....	.....	.....	.....	24.41
Nigger	1988	.....	.....	.....	34.80	37.70	.....	.....	.....	36.25
Skipper	.....	227	.....	22.53	28.20	.....	.....	.....	.....	25.37
Awned, glumes glabrous, brown:										
Mediterranean	1909	.....	34.53	20.87	25.37	40.10	16.60	25.77	35.00	28.32
Missouri Bluestem	1912	.....	31.87	19.87	32.80	28.17	28.60	21.77	34.67	28.25
Spade	1935	.....	35.69	20.60	27.80	28.63	26.13	17.67	37.80	27.76
Eclipse	.....	105	24.93	19.43	24.57	38.20	24.60	22.67	35.83	27.18
Rieti	1745	.....	32.27	16.70	31.67	29.50	28.63	15.90	35.00	27.10
Swamp	1934	.....	23.87	19.53	29.80	32.03	25.73	19.30	36.93	26.74
Rocky Mountain	1930	.....	33.64	18.97	26.37	26.73	27.60	.....	.....	26.66
Cox	1960	.....	37.88	16.80	28.33	25.00	.....	.....	.....	27.00
Onigara	1695	.....	26.00	18.93	17.43	.....	.....	.....	.....	20.79
Hybrid[5]	3609	.....	36.72	19.20	.....	.....	.....	.....	.....	27.96
Awned, glumes pubescent, white:										
Pride of Genesee	1937	.....	33.73	18.80	25.57	28.13	21.70	12.27	29.57	24.54
Rural New Yorker	.....	191	32.10	17.33	31.67	28.30	24.07	.....	.....	26.69
Red Giant (Velvet Red Giant)	1975	.....	34.03	13.47	26.00	.....	.....	.....	.....	24.50
Awned, glumes pubescent, brown:										
Japanese Velvet Chaff	1757	.....	34.28	13.87	21.33	.....	.....	.....	.....	23.16
Awnless, glumes glabrous, white:										
Fultz[6]	.....	84	32.28	18.08	29.66	31.51	19.44	20.00	30.46	25.92
Fultzo-Mediterranean	1980	.....	29.20	18.73	26.90	30.90	16.13	20.73	37.67	25.75
Four-Rowed Fultz	.....	361	.....	.....	.....	.....	23.03	19.10	24.33	22.15
Jersey Fultz	.....	363	.....	.....	.....	.....	.....	20.37	35.73	28.05
Purple Straw	1915	.....	34.13	22.40	30.00	26.57	13.87	.....	.....	25.39
Frostproof May	2007	.....	22.27	21.73	33.47	27.40	.....	.....	.....	26.22
Diminum	2191	.....	.....	21.87	33.27	41.40	.....	.....	.....	32.18
Oakley (Extra Early Oakley)	1951	.....	22.41	23.33	26.70	.....	.....	.....	.....	24.15
Maryland Flint	1949	.....	24.53	19.07	.....	.....	.....	.....	.....	21.80

[1] Schmitz, Nickolas. Wheat—variety tests and diseases. Md. Agr. Exp. Sta. Bul. 147, p. 33–45. 1910.

[2] Cereal Investigations number.

[3] Another variety having brown glumes is grown under this name. The one here reported appears to be identical with Fulcaster.

[4] Two strains of this variety are grown.

[5] The parentage of this hybrid is stated on page 18.

[6] Average of 14, 19, 15, 12, 15, 13, and 13 check plats for the years 1908, 1909, 1910, 1911, 1912, 1913, and 1914, respectively.

TABLE III.—*Annual and average yields of varieties of winter wheat grown at the Maryland Agricultural Experiment Station (College Park) and at Arlington Farm, Va., for the years stated*—Continued.

COLLEGE PARK (82 VARIETIES)—Continued.

Group and variety.	C. I. No.	Maryland station No.	Yield per acre (bushels).							
			1908	1909	1910	1911	1912	1913	1914	Average.
SOFT RED WINTER—continued.										
Awnless, glumes glabrous, brown:										
China	.....	194	36.57	23.77	29.33	42.87	22.00	24.67	39.00	31.17
Currell (Currell Prolific)	.....	89	30.10	23.07	28.60	41.43	20.20	22.10	41.87	9.262
Red Clawson (Royal Red Clawson)	.....	188	33.50	23.03	27.27	35.50	20.60	25.87	36.67	28.92
Gill	1987	.....	31.00	22.13	30.17	37.53	26.67	13.27	36.73	28.21
Beechwood (Beechwood Hybrid)	1972	.....	30.93	17.67	27.63	34.87	16.97	21.07	31.83	25.85
Poole	.....	198	25.40	15.17	27.47	27.37	19.83	11.57	34.93	23.11
Red Wave	.....	351	.....	.....	.....	23.10	18.43	15.00	31.00	21.88
Beechwood (Beechwood Hybrid) (Ky.)	.....	364	.....	.....	.....	.....	.....	22.67	36.73	29.70
Boughton	1993	.....	38.26	17.30	28.13	40.17	14.00	.....	.....	27.56
Red Clawson (Early Red Clawson)	1922	.....	33.07	18.40	26.73	33.17	20.93	.....	.....	26.46
Michigan Amber	1969	.....	35.43	14.73	29.40	30.20	15.50	.....	.....	25.05
Jones Red Chief (Jones Early Red Chief)	2498	.....	26.40	21.73	28.57	25.97	21.03	.....	.....	24.54
Poole	1979	.....	33.20	14.73	33.00	35.93	.....	.....	.....	29.22
Harvest King	.....	193	32.80	20.30	32.93	27.30	.....	.....	.....	28.33
Red Chief (Early Red Chief)	.....	350	.....	.....	34.53	28.10	24.40	.....	.....	29.01
Arcadian (Early Arcadian)	1749	.....	25.47	10.00	.....	.....	.....	.....	.....	17.74
New York No. 10	.....	347	.....	.....	29.43	25.20	.....	.....	.....	27.32
Rochester (Rochester Red)	.....	355	.....	.....	.....	25.93	15.77	.....	.....	20.85
Awnless, glumes pubescent, white:										
Jones Winter Fife	1933	.....	37.23	16.67	30.67	28.03	19.40	.....	.....	26.40
Mealy	1925	.....	37.75	14.60	35.20	25.57	.....	.....	.....	28.28
Canadian Hybrid	1747	.....	37.75	16.33	29.93	26.80	.....	.....	.....	27.70
Hybrid[1]	3618	.....	34.92	16.37	.....	.....	.....	.....	.....	25.65
SOFT WHITE OR AMBER WINTER.										
Awned, glumes glabrous, white:										
New Amber Longberry	1973	.....	34.92	18.33	31.37	27.70	15.00	.....	.....	25.60
Oatka (Oatka Chief)	1985	.....	.....	.....	29.87	40.20	.....	.....	.....	35.04
Awned, glumes glabrous, brown:										
Klondike	.....	356	.....	.....	.....	.....	10.03	19.93	35.57	21.84
Genesee Giant (Early Genesee Giant)	1744	.....	29.20	17.80	33.10	24.70	14.77	.....	.....	23.91
Awned, glumes pubescent, white:										
Bearded Winter Fife	1942	.....	39.41	20.63	27.87	43.73	15.50	25.10	34.67	29.56
Awned, glumes pubescent, brown:										
Bearded Velvet Chaff	2500	.....	35.73	17.90	31.00	14.90	.....	.....	.....	24.88
Awnless, glumes glabrous, white:										
Martin Amber	1974	.....	28.67	16.67	33.73	27.17	9.33	23.00	31.67	24.32
Awnless, glumes glabrous, brown:										
Dawson Golden Chaff	1733	.....	37.49	19.87	33.57	26.47	14.27	23.40	35.13	27.17
Gold Coin	.....	353	.....	.....	.....	23.83	18.67	11.47	32.70	21.67
Dawson Golden Chaff	.....	187	30.83	17.73	.....	.....	.....	.....	.....	24.28
Massey	.....	357	.....	.....	.....	.....	23.33	16.43	.....	19.88
HARD RED WINTER.										
Awned, glumes glabrous, white:										
Malakof	.....	365	.....	.....	.....	.....	.....	23.43	34.57	29.00
Turkey	1782	.....	30.30	14.27	25.17	.....	.....	.....	.....	23.25
Awnless, glumes pubescent, white: Haynes[2]	1505	.....	.....	14.67	23.37	.....	.....	.....	.....	19.02

[1] The parentage of this hybrid is stated on page 18.
[2] Spring wheat grown from fall seeding.

TABLE III.—*Annual and average yields of varieties of winter wheat grown at the Maryland Agricultural Experiment Station (College Park) and at Arlington Farm, Va., for the years stated*—Continued.

ARLINGTON FARM, VA. (43 VARIETIES).

Group and variety.	C. I. No.	Yield per acre (bushels).					
		1910	1911	1912	1913	1914	Average.
SOFT RED WINTER.							
Awned, glumes glabrous, white:							
Lancaster [1]	1945	31.00	28.80	29.08	26.50	33.30	29.74
Mammoth Red	2008	29.17	25.30	29.20	25.20	28.20	27.41
Dietz (Dietz Longberry) [2]	1981	31.49	25.20	28.34	21.10	28.20	26.87
Hybrid [3]	3608	29.66	21.20	31.67	19.07	25.30	25.38
Bearded Purple Straw	1911	25.03	20.10	28.67	23.20	22.30	23.86
Hybrid [3]	3611	20.00	20.70	21.60	15.70	24.70	20.54
Stoner (Miracle)	2890	.....	25.20	30.17	22.00	32.30	27.42
Hybrid [3]	3617	.....	21.70	34.67	21.80	27.80	26.49
Fishhead	1732	30.83	17.30	27.33	21.70	.....	24.29
Hybrid [3]	3612	.....	13.80	20.27	19.50	24.50	19.52
Silver Sheaf (Jones Silver Sheaf Longberry)	2496	.....	.....	.....	17.50	22.30	19.90
Fulcaster (Acme)	3115	.....	19.70	24.33	.....	.....	22.02
Awned, glumes glabrous, brown:							
Rocky Mountain	1930	26.83	25.80	31.50	26.20	26.30	27.33
Missouri Bluestem	1912	22.17	28.60	32.08	22.50	28.70	26.81
Hybrid [3]	3609	24.33	14.70	32.53	18.01	23.30	22.57
Do. [3]	3614	.....	16.80	30.07	19.20	31.30	24.34
Do. [3]	3613	.....	12.00	22.27	19.70	31.20	21.29
Rocky Mountain	3638	.....	.....	28.67	19.30	24.70	24.22
Similar to C. I. No. 3614	3640	.....	.....	.....	17.60	.....	.....
Awned, glumes pubescent, white:							
Hybrid [3]	3616	25.67	20.00	29.67	16.10	31.00	24.49
Virginia (hybrid) [3]	3277	.....	24.50	35.15	21.00	21.50	25.54
Awnless, glumes glabrous, white:							
Purple Straw	1915	24.59	25.80	37.17	34.70	38.20	32.09
Fultz	1923	37.65	25.20	31.22	22.70	29.10	29.17
Purple Straw	1957	26.00	31.30	33.08	24.20	30.80	29.08
Maryland Flint	1949	22.33	32.30	29.08	23.50	23.70	26.18
Fultzo-Mediterranean	1980	18.00	21.70	28.83	19.20	22.50	22.05
Kentucky	[4] B-383	.....	.....	29.83	23.30	.....	26.57
Awnless, glumes glabrous, brown:							
Poole	1979	31.66	24.30	31.92	26.60	29.20	28.74
Hybrid [3]	3610	30.33	16.70	29.20	22.00	21.00	23.85
Michigan Amber	1969	.....	28.00	28.83	21.00	21.00	24.71
Currell (Currell Prolific)	3326	.....	.....	.....	20.20	30.30	25.25
China	180	.....	.....	.....	21.80	20.00	20.90
Awnless, glumes pubescent, white:							
Jones Winter Fife	1933	26.67	22.80	24.00	24.70	24.70	24.57
Hybrid [3]	3618	20.00	22.50	30.55	20.80	22.20	23.21
SOFT WHITE OR AMBER WINTER.							
Awned, glumes glabrous, white:							
New Amber Longberry	1973	.....	26.50	29.50	22.70	29.50	27.05
Awned, glumes glabrous, brown:							
Genesee Giant (Early Genesee Giant)	1744	24.17	20.30	30.67	28.40	32.50	27.21
Awned, glumes pubescent, white:							
Bearded Winter Fife	1942	30.00	26.60	36.42	24.90	23.30	28.24
Do	4204	.....	.....	.....	22.80	36.80	29.80
Awnless, glumes glabrous, white:							
Martin Amber	1974	25.67	21.90	31.50	20.00	23.70	24.55
Awnless, glumes glabrous, brown:							
Dawson Golden Chaff	1733	25.06	24.80	36.00	25.80	35.20	29.37
HARD RED WINTER.							
Awned, glumes glabrous, white:							
Kharkof (Acme Bred Kharkof)	3615	.....	.....	22.27	16.20	.....	19.24
Awnless, glumes glabrous, white:							
Power [5]	1506	14.50	.....	.....	.....	.....	.....
DURUM.							
Berdiansk [5]	1586	18.33	8.10	23.00	13.70	.....	15.78

[1] Another variety having brown glumes is grown under this name. The one here reported appears to be identical with Fulcaster.

[2] Average of 6, 8, 10, 18, and 13 check plats for 1910, 1911, 1912, 1913, and 1914, respectively.

[3] The parentage of these hybrids is stated on page 18.

[4] Kentucky station number.

[5] Spring wheats grown from fall seeding.

Of the 43 varieties grown at Arlington 36 were included in the tests of 1914. Those few that were discontinued in 1913 and previous years at Arlington did not yield well enough or were too inferior in quality to warrant their continuance in the plat tests. This also generally was true of the 65 varieties that have been eliminated at College Park. As the tests progressed it was necessary to discard some of the inferior sorts in order to make room for new and untried ones that appeared on the market.

MISCELLANEOUS DATA.

It is important in making a comparison of varieties to consider data other than those of yield. Table IV shows the average dates of heading and of ripening, average height, average yield of grain and of straw, and average weight per bushel for the varieties included in Table III.

Winter wheat at College Park and Arlington usually is fully headed by May 20, and ripe about one month later. The average dates of ripening, as given in Table IV, are remarkably uniform, being with few exceptions within a period of 3 or 4 days. There is no marked difference between the various groups, the one to which Fultz, Purple Straw, etc., belong probably being the earliest. The two earliest varieties grown at both Arlington and College Park are Fishhead (C. I. No. 1732) and Maryland Flint (C. I. No. 1949). It is generally believed that the early varieties yield more than the midseason and late ones, but if the early and late varieties in the several larger groups are compared, no definite correlation between earliness and yield is shown. Most of the best varieties in each group are those that are midseason in maturity. The China, the leading awnless variety at College Park, is one of the latest varieties, which is contrary to the belief that late varieties are not high yielders. However, this variety is very resistant to scab and rust, thus partially offsetting the disadvantage of late maturity.

The yields of straw in the winter-wheat varieties, as shown in Table IV, are quite variable. Those that rank high in yield of straw do not in all cases rank high in yield of grain. On the other hand, those that are high in yield of grain are not always heavy producers of straw.

The average weight per bushel at Arlington is higher than at College Park, because it is always determined after the grain is fanned, while at College Park it is usually determined as the grain comes from the thrasher. However, those varieties which have been best at Arlington in quality of grain, as determined by weight per bushel, have been best at College Park also, as a rule.

TABLE IV.—*Miscellaneous data for varieties of winter wheat grown at the Maryland Agricultural Experiment Station (College Park) and at Arlington Farm, Va., for the periods stated.*

COLLEGE PARK (82 VARIETIES), 1908 TO 1914, INCLUSIVE.

Group and variety	C. I. No.	Maryland station No.	Number of years grown.	Average date—Headed.	Average date—Ripe.	Average height.	Average yield per acre.—Grain.	Average yield per acre.—Straw.[1]	Average weight per bushel.
SOFT RED WINTER.									
						Inches.	*Bushels.*	*Pounds.*	*Pounds.*
Awned, glumes glabrous, white:									
Mammoth Red	2008	.....	7	May 21	June 22	51	31.09	3,300	58.2
Bearded Purple Straw	1911	.....	7	...do.....	June 21	51	30.95	4,060	59.2
Turkish Amber	.....	195	7	...do.....	June 22	51	30.11	3,650	58.8
Lancaster	1945	.....	7	...do.....	...do.....	51	30.03	3,900	58.7
Dietz (Dietz Longberry)	1981	.....	7	...do.....	...do.....	51	29.53	4,140	58.2
Dietz	.....	95	7	...do.....	...do.....	51	28.71	3,660	59.2
Gipsy	.....	199	7	May 23	...do.....	51	28.04	3,870	58.3
Fishhead	1732	.....	7	May 15	June 21	48	27.97	3,440	58.7
Valley	.....	92	7	May 21	June 23	50	26.63	3,500	58.1
Reliable	.....	189	7	May 22	June 22	49	24.46	3,470	56.9
Silver Sheaf (Jones Silver Sheaf Longberry)	2496	.....	7	May 23	...do.....	49	23.21	3,130	56.4
Doub	.....	348	5	May 20	...do.....	49	26.04	[2] 3,310	60.1
Rudy	.....	349	5	May 22	June 23	47	26.01	[2] 3,190	57.8
Fulcaster	.....	352	4	...do.....	June 22	51	28.34	[2] 3,830	59.4
Fulcaster (Acme)	.....	354	4	...do.....	June 23	50	27.56	[2] 3,610	60.1
Stoner (Miracle)	.....	358	3	...do.....	June 22	53	25.47	[2] 3,820	59.5
Diamond Grit	1941	.....	5	May 23	June 24	48	24.22	3,000	58.0
Servia	1673	.....	3	May 21	...do.....	45	27.62	4,100	[3] 53.6
Tuscan Island	1984	.....	3	May 19	June 21	50	27.45	3,640	54.7
Budapest	1739	.....	3	May 20	June 22	46	26.90	3,070	55.3
Missouri Bluestem	1910	.....	3	May 19	June 24	49	24.41	3,510	53.4
Nigger	1988	.....	2	May 22	June 23	49	36.35	[2] 3,760	[3] 61.5
Skipper	.....	227	2	May 19	...do.....	52	25.37	[2] 4,600	53.5
Awned, glumes glabrous, brown:									
Mediterranean	1909	.....	7	May 20	June 22	49	28.32	3,650	57.5
Missouri Bluestem	1912	.....	7	May 22	...do.....	48	28.25	3,570	57.5
Spade	1935	.....	7	May 20	...do.....	48	27.76	3,510	56.5
Eclipse	.....	105	7	May 21	...do.....	49	27.18	3,650	56.4
Rieti	1745	.....	7	...do.....	...do.....	48	27.10	3,400	55.5
Swamp	1934	.....	7	May 22	June 23	48	26.74	3,630	57.8
Rocky Mountain	1930	.....	5	May 19	June 22	50	26.66	3,530	57.5
Cox	1960	.....	4	May 20	...do.....	45	27.00	2,770	56.6
Onigara	1695	.....	3	May 13	June 21	42	20.79	2,020	53.8
Hybrid	3609	.....	2	May 20	June 23	47	27.96	4,250	[3] 54.2
Awned, glumes pubescent, white:									
Pride of Genesee	1937	.....	7	May 23	...do.....	47	24.54	3,220	57.6
Rural New Yorker	.....	191	5	May 21	...do.....	50	26.69	3,770	57.9
Red Giant (Velvet Red Giant)	1975	.....	3	...do.....	June 21	44	24.50	3,120	53.6
Awned, glumes pubescent, brown:									
Japanese Velvet Chaff	1757	.....	3	May 19	June 23	47	23.16	2,890	55.1
Awnless, glumes glabrous, white:									
Fultz	.....	84	7	May 21	June 21	49	25.92	3,640	56.8
Fultzo-Mediterranean	1980	.....	7	May 19	...do.....	45	25.75	2,960	57.2
Four-Rowed Fultz	.....	361	3	May 21	June 20	44	22.15	[2] 3,120	57.0
Jersey Fultz	.....	363	2	May 24	June 22	47	28.05	[2] 3,720	59.8
Purple Straw	1915	.....	5	May 19	...do.....	49	25.39	3,680	56.9
Frostproof May	2007	.....	4	...do.....	June 21	47	26.22	4,140	58.6
Diminum	2191	.....	3	May 21	June 23	47	32.18	[2] 3,760	57.0
Oakley (Extra Early Oakley)	1951	.....	3	May 17	June 20	48	24.15	3,510	54.8
Maryland Flint	1949	.....	2	May 16	June 21	48	21.80	4,780	[3] 52.3

[1] Data on yield of straw were not taken in 1908; hence, the average yield is for one year less than the total number of years the variety was grown. Varieties introduced after 1908, for which data on yield of straw are available for the full number of years, are noted in the table.

[2] Data on yield of straw taken each year the variety was grown.

[3] Data on weight per bushel for one year less than the full number the variety was grown.

TABLE IV.—*Miscellaneous data for varieties of winter wheat grown at the Maryland Agricultural Experiment Station (College Park) and at Arlington Farm, Va., for the periods stated*—Continued.

COLLEGE PARK (82 VARIETIES), 1908 TO 1914, INCLUSIVE—Continued.

Group and variety.	C. I. No.	Maryland station No.	Number of years grown.	Average date— Headed.	Average date— Ripe.	Average height.	Average yield per acre. Grain.	Average yield per acre. Straw.	Average weight per bushel.
SOFT RED WINTER—continued.									
						Inches.	*Bushels.*	*Pounds.*	*Pounds.*
Awnless, glumes glabrous, brown:									
China	.....	194	7	May 24	June 24	51	31.17	3,980	58.0
Currell (Currell Prolific)	.....	89	7	May 20	June 21	50	29.62	3,580	57.9
Red Clawson (Royal Red Clawson)	.....	188	7	...do.....	June 22	47	28.92	3,270	57.5
Gill	1987	.....	7	...do.....	June 21	47	28.21	3,240	56.9
Beechwood (Beechwood Hybrid)	1972	.....	7	May 21	June 22	49	25.85	3,470	56.0
Poole	.....	198	7	May 20	...do.....	48	23.11	3,110	56.3
Red Wave	.....	351	4	May 24	June 23	46	21.88	[1] 2,600	57.3
Beechwood (Beechwood Hybrid) (Ky.)	.....	364	2	May 23	June 21	48	29.70	[1] 3,910	59.5
Boughton	1993	.....	5	May 20	...do.....	50	27.57	3,680	[2] 54.2
Red Clawson (Early Red Clawson)	1922	.....	5	May 19	...do.....	49	26.46	3,400	55.7
Michigan Amber	1969	.....	5	...do.....	...do.....	49	25.05	3,460	[2] 55.1
Jones Red Chief (Jones Early Red Chief)	2498	.....	5	May 21	June 23	45	24.54	3,070	54.3
Poole	1979	.....	4	...do.....	June 22	48	29.22	3,650	54.7
Harvest King	.....	193	4	May 20	June 23	47	28.33	2,820	56.5
Red Chief (Early Red Chief)	.....	350	3	May 22	June 22	49	29.01	[1] 3,690	56.0
Arcadian (Early Arcadian)	1749	.....	2	May 20	June 23	43	17.74	3,600	[2] 44.4
New York No. 10	.....	347	2	May 21	June 22	45	27.32	[1] 2,610	58.8
Rochester (Rochester Red)	.....	355	2	May 23	June 23	48	20.85	[1] 3,130	58.3
Awnless, glumes pubescent, white:									
Jones Winter Fife	1933	.....	5	May 22	June 24	48	26.40	3,180	56.0
Mealy	1925	.....	4	May 20	June 22	45	28.28	3,270	53.5
Canadian Hybrid	1747	.....	4	May 22	June 24	46	27.70	3,280	55.4
Hybrid	3618	.....	2	May 23	June 23	46	25.65	3,200	[2] 53.2
SOFT WHITE OR AMBER WINTER.									
Awned, glumes glabrous, white:									
New Amber Longberry	1973	.....	5	May 24	June 24	53	25.26	3,480	56.0
Oatka (Oatka Chief)	1985	.....	2	May 25	June 26	49	35.04	[1] 3,940	[3] 59.5
Awned, glumes glabrous, brown:									
Klondike	.....	356	3	May 26	June 24	46	21.84	[1] 2,860	56.2
Genesee Giant (Early Genesee Giant)	1744	.....	5	May 22	June 23	47	23.91	3,310	55.2
Awned, glumes pubescent, white:									
Bearded Winter Fife	1942	.....	7	...do.....	June 22	48	29.56	3,370	57.8
Awned, glumes pubescent, brown:									
Bearded Velvet Chaff	2500	.....	4	May 23	June 24	43	24.88	2,480	56.5
Awnless, glumes glabrous, white:									
Martin Amber	1974	.....	7	May 26	...do.....	48	24.32	3,390	58.2

[1] Data on yield of straw taken each year the variety was grown.
[2] Data on weight per bushel for one year less than the full number the variety was grown.

TABLE IV.—*Miscellaneous data for varieties of winter wheat grown at the Maryland Agricultural Experiment Station (College Park) and at Arlington Farm, Va., for the periods stated*—Continued.

COLLEGE PARK (82 VARIETIES), 1908 TO 1914, INCLUSIVE—Continued.

Group and variety.	C. I. No.	Maryland station No.	Number of years grown.	Average date—		Average height.	Average yield per acre.		Average weight per bushel.
				Headed.	Ripe.		Grain.	Straw.	
SOFT WHITE OR AMBER WINTER—continued.									
Awnless, glumes glabrous, brown:									
Dawson Golden Chaff	1733	.....	7	May 22	June 22	*Inches.* 46	*Bushels.* 27.17	*Pounds.* 3,350	*Pounds.* 55.4
Gold Coin	.....	353	4	May 24	...do.....	44	21.67	[1] 2,620	57.9
Dawson Golden Chaff	.....	187	2	May 19	...do.....	44	24.28	2,480	54.2
Massey	.....	357	2	May 24	June 24	44	19.88	[1] 3,400	57.8
HARD RED WINTER.									
Awned, glumes glabrous, white:									
Malakof	.....	365	2	May 23	June 21	51	29.00	[1] 4,020	60.7
Turkey	1782	.....	3	May 18	June 20	45	23.25	3,230	[2] 52.3
Awnless, glumes pubescent, white:									
Haynes	1505	.....	2	May 24	June 26	49	19.02	[1] 3,930	52.1

ARLINGTON FARM, VA. (43 VARIETIES), 1910 TO 1914, INCLUSIVE.

Group and variety.	C. I. No.	Number of years grown.	Average date—		Average height.[3]	Average yield per acre.		Average weight per bushel.
			Headed.[3]	Ripe.		Grain.	Straw.[3]	
SOFT RED WINTER.								
Awned, glumes glabrous, white:					*Inches.*	*Bushels.*	*Pounds.*	*Pounds.*
Lancaster	1945	5	May 21	June 20	48	29.74	4,390	59.9
Mammoth Red	2008	5	May 22	...do.....	51	27.41	4,460	61.0
Dietz (Dietz Longberry)	1981	5	May 23	June 19	49	26.87	3,780	[4] 61.1
Hybrid	3608	5	May 25	June 21	46	25.38	4,140	[4] 60.9
Bearded Purple Straw	1911	5	May 23	June 20	49	23.86	4,200	61.0
Hybrid	3611	5	May 26	June 22	43	20.54	3,780	[4] 60.9
Stoner (Miracle)	2980	4	May 23	June 19	48	27.42	3,900	61.1
Hybrid	3617	4	May 26	June 22	44	26.49	4,530	61.0
Fishhead	1732	4	[5] May 18	June 17	[5] 42	24.29	[5] 2,640	60.3
Hybrid	3612	4	May 26	June 22	46	19.52	[5] 3,960	57.1
Silver Sheaf (Jones Silver Sheaf Longberry)	2496	2	...do....	June 21	51	19.90	5,600	60.0
Fulcaster (Acme)	3115	2	May 24	...do.....	46	22.02	2,960	60.0
Awned, glumes glabrous, brown:								
Rocky Mountain	1930	5	May 23	June 22	49	27.33	4,660	60.8
Bluestem	1912	5	May 24	June 23	49	26.81	4,610	60.7
Hybrid	3609	5	May 27	June 24	45	22.57	[5] 4,240	[4] 60.4
Do	3614	4	May 25	June 22	48	24.34	[5] 4,880	58.4
Do	3613	4	...do.....	June 23	48	21.29	[5] 4,440	58.9
Rocky Mountain	3638	3	May 24	June 22	52	24.22	5,510	60.8
Similar to C. I. No. 3614	3640	1	May 21	...do.....	46	17.60	2,380	60.0
Awned, glumes pubescent, white:								
Hybrid	3616	5	May 25	[4] June 21	47	24.49	3,750	[4] 60.1
Virginia (hybrid)	3277	4	May 27	June 24	47	25.54	3,940	60.6

[1] Data on yield of straw taken each year the variety was grown.
[2] Data on weight per bushel for one year less than the full number the variety was grown.
[3] Dates of heading, height, and yield of straw are for four years only on all varieties grown for five years. In varieties grown for a less number of years these notes are for all years unless otherwise stated.
[4] For four years only.
[5] For three years only.

TABLE IV.—*Miscellaneous data for varieties of winter wheat grown at the Maryland Agricultural Experiment Station (College Park) and at Arlington Farm, Va., for the periods stated*—Continued.

ARLINGTON FARM, VA. (43 VARIETIES), 1910 TO 1914, INCLUSIVE—Continued.

Group and variety.	C. I. No.	Number of years grown.	Average date—		Average height.	Average yield per acre.		Average weight per bushel.
			Headed.	Ripe.		Grain.	Straw.	
SOFT RED WINTER—contd.								
Awnless, glumes glabrous, white:					*Inches.*	*Bushels.*	*Pounds.*	*Pounds.*
Purple Straw	1915	5	May 19	June 18	46	32.09	4,320	61.4
Fultz	1923	5	May 22	...do....	48	29.17	4,200	60.8
Purple Straw	1957	5	May 17	...do....	49	29.08	4,590	61.3
Maryland Flint	1949	5	May 22	June 17	46	26.18	4,580	[1] 60.9
Fultzo-Mediterranean	1980	5	May 23	June 22	45	22.05	3,780	[1] 61.5
Kentucky	B-383	2	May 21	June 21	46	26.57	4,100	60.5
Awnless, glumes glabrous, brown:								
Poole	1979	2	May 22	June 22	48	28.74	4,510	60.4
Hybrid	3610	5	May 26	[1] June 30	41	23.85	3,180	[1] 60.2
Michigan Amber	1969	4	May 23	June 21	50	24.71	4,610	60.8
Currell (Currell Prolific)	3326	2	May 22	June 20	50	25.25	4,610	61.0
China	180	2	May 28	June 24	54	20.90	5,700	61.0
Awnless, glumes pubescent, white:								
Jones Winter Fife	1933	5	May 26	June 22	45	24.57	[2] 3,880	60.9
Hybrid	3618	5	...do....	...do. [1] ...	45	23.31	3,840	[1] 60.4
SOFT WHITE OR AMBER WINTER.								
Awned, glumes glabrous, white:								
New Amber Longberry	1973	5	May 28	June 24	52	27.05	4,830	60.0
Awned, glumes glabrous, brown:								
Genesee Giant (Early Genesee Giant)	1744	5	May 25	...do....	46	27.21	3,970	59.0
Awned, glumes pubescent, white:								
Bearded Winter Fife	1942	5	May 23	June 21	46	28.24	4,210	60.2
Do	4204	2	May 24	...do....	47	29.80	4,610	60.3
Awnless, glumes glabrous, white:								
Martin Amber	1974	2	May 26	June 25	46	24.55	4,580	60.8
Awnless, glumes glabrous, brown:								
Dawson Golden Chaff	1733	2	May 25	June 21	47	29.37	4,110	60.2
HARD RED WINTER.								
Awned, glumes glabrous, white:								
Kharkof (Acme Bred Kharkof)	3615	2	May 27	June 24	39	19.24	2,980	61.0
Awnless, glumes glabrous, white:								
Power [3]	1506	1	May 10	June 26	55	14.50	.....	.....
DURUM.								
Berdiansk [3]	1586	4	[2] May 25	...do....	[2] 40	15.78	[2] 2,150	61.0

[1] For four years only. [2] For three years only. [3] Spring wheats grown from fall seeding.

HYBRIDS.

From Tables III and IV it will be noted that 11 of the wheats included in the tests at Arlington are hybrids. Two of these hybrids were also included in the varietal tests at College Park in 1908 and 1909, and are shown in Table III. These 11 hybrids are now prac-

tically all that remain of about 575, most of which have been grown at various times at College Park and Arlington. Of this number, 368 were made at Halstead, Kans., in 1900, by Mr. Deane B. Swingle. These were transferred to College Park in 1901, where about 172 additional hybrids were made by Mr. Mark Alfred Carleton in that year, thus bringing the number up to 540. They were grown and selected from year to year, the number being gradually reduced until the fall of 1907. At that time those that yet remained, together with about 35 other hybrids made by Mr. H. A. Miller in 1905 at College Park, were transferred to Arlington.

Finally, in the fall of 1909, when the total number had been reduced to less than 50, 11 of the most promising were included in the regular varietal tests. The parentage of the 11 selections from hybrids which are included in Table III is as follows:

C.I.No.
3277, C. I. No. 1344 × Jones Winter Fife.
3608, Diehl Mediterranean × Jones Winter Fife.
3609, Shirosawa × Jones Winter Fife.
3610, Jones Winter Fife × Dawson (Dawson Golden Chaff).
3611, (Crimean × Onigara) × (Reddish White Bearded × Japanese No. 1).

C.I.No.
3612, Fultz × Eclipse.
3613, Currell (Currell Prolific) × Dietz.
3614, Currell × Eclipse.
3616, C. I. No. 1344 × Jones Winter Fife.
3617, (Penquite Velvet Chaff × Zimmerman) × (Zimmerman × Turkey).
3618, Jones Winter Fife × C. I. No. 1405.

C. I. Nos. 3277, 3608, 3609, 3610, 3616, and 3618 are selections from the hybrids made by Mr. Swingle at Halstead, Kans., in 1900; C. I. Nos. 3611 and 3617 are selections from those made in 1901 by Mr. Carleton at College Park, Md.; and C. I. Nos. 3612, 3613, and 3614 are selections from those made by Mr. Miller at the same place in 1905.

GROUPS OF SIMILAR VARIETIES.

For convenience in comparing the yields of similar wheats and to avoid confusion of varietal names in the future, the varieties in Tables III and IV have been grouped in accordance with some of the most obvious characters. In this grouping no attempts have been made to distinguish between white and amber kernels or between white and yellow or red and brown glumes. This classification is practically identical with the one published in Farmers' Bulletin 616.[1] It will be noted from Tables III and IV that practically all the varieties included in the tests are of the soft red and soft white groups. By far the greater number belong to the first group. Several of the hard red winter wheats have been tested, but with no marked success.

[1] Leighty, C. E. Winter-wheat varieties for the eastern United States. U. S. Dept. Agr. Farmers' Bul. 616, 14 p., 6 fig., 1914.

The wheats of this group are not adapted to the more humid areas of the United States.

SOFT RED WINTER.

Awned, glumes glabrous, white.—In order of yield, the leading varieties of this group that have been tested are the Lancaster, C. I. No. 1945; Mammoth Red, C. I. No. 2008; Dietz (Dietz Longberry), C. I. No. 1981; Bearded Purple Straw, C. I. No. 1911; and Stoner or "Miracle," C. I. No. 2980 and Maryland No. 358. These varieties are all quite similar (fig. 2). They are the most popular milling wheats

FIG. 2.—Heads of six varieties of winter wheat grown at the Maryland Agricultural Experiment Station and at Arlington Farm: 1, Dietz (Dietz Longberry); 2, Missouri Bluestem; 3, Purple Straw; 4, China; 5, Bearded Winter Fife; 6, Dawson Golden Chaff.

grown in the eastern United States. Probably the most widely advertised variety of this group in recent years is the Stoner or "Miracle" (Fulcaster). Great claims have been made for its free tillering habit and its heavy yields. Seed of the "Miracle" wheat was sold widely at extremely high prices, but in no instance did the results obtained justify the extravagant claims which were made. Data presented in another portion of this bulletin show that the "Miracle" variety possesses no greater tillering power than other similar wheats.

Awned, glumes glabrous, brown.—The Mediterranean, C. I. No. 1909, and the Missouri Bluestem, C. I. No. 1912, are the best varieties in this group. The Rocky Mountain, C. I. No. 1930, has been the leading variety at Arlington, but has not done so well at College Park.

The varieties Spade, C. I. No. 1935, and Eclipse, Maryland No. 105, are also among the best at College Park.

The Missouri Bluestem when first grown at Arlington was a mixture of a white-chaffed and a red-chaffed wheat. Selections were made, and in 1913 the best strain, a red-chaffed one, was substituted for the mixed stock in the tests. The white-chaffed strain was inferior and was discarded. The Missouri Bluestem variety, C. I. No. 1910, tested at College Park from 1908 to 1910, was identical with the white-chaffed strain just mentioned.

Awned, glumes pubescent, white.—Only five varieties included under this group have been tested, of which two were grown at Arlington and three at College Park. The Virginia, C. I. No. 3277, a hybrid variety, is of sufficient promise to warrant special mention. While it has not ranked unusually high in yield, the quality of grain in this variety is superior to that of the other four varieties.

Awnless, glumes glabrous, white.—The Fultz, C. I. No. 1923 and Maryland No. 84, one of the oldest and best known varieties of soft winter wheat, probably is the most valuable of the several varieties belonging to this group. However, at Arlington the Purple Straw, C. I. No. 1915, has outyielded it in a 5-year test by nearly 3 bushels per acre. Unfortunately, the Purple Straw was discontinued at College Park in 1912, and consequently data for only five years are available there. It has produced 32.09 bushels per acre, the highest average yield of any variety, at Arlington Farm during the five years from 1910 to 1914.

The Fultzo-Mediterranean, C. I. No. 1980, a rather popular variety in Maryland and Virginia, has not compared favorably in yield with either Purple Straw or Fultz. At College Park it has yielded nearly as well as the Fultz. Of the 29 varieties that have now been tested for seven years at College Park the Fultzo-Mediterranean ranks twenty-fifth in average yield per acre. The popularity of this variety is due largely to its short, stiff straw and its consequent freedom from lodging.

Awnless, glumes glabrous, brown.—The leading varieties of this group are the Poole, C. I. No. 1979; Currell (Currell Prolific), C. I. No. 3326; China, C. I. No. 180 and Maryland No. 194; and Red Clawson (Royal Red Clawson), Maryland No. 188. Of these the China has been the most promising at College Park, while the Poole takes the lead at Arlington. Regardless of group, the China has been the highest yielding wheat tested at College Park. This variety, however, has not yielded especially well at Arlington, where it has been included in the tests only since 1912. Just why a few varieties are particularly promising at College Park and of little value at Arlington, and vice versa, the writer can not say. The records of the China

and Purple Straw at the two places are among the best examples of this variation.

SOFT WHITE OR AMBER WINTER.

Awned, glumes pubescent, white.—The Bearded Winter Fife, C. I No. 1942, has been the most promising of the so-called velvet-chaffed wheats tested at College Park and Arlington. A selection (C. I. No. 4204) which is quite similar to it has also been of particular promise at Arlington. Of the several varieties originated by Mr. A. N. Jones, of New York, that have been tested at College Park and Arlington, the Bearded Winter Fife is considerably the best.

Awnless, glumes glabrous, brown.—The Dawson (Dawson Golden Chaff) C. I. No. 1733, is the only representative of this group included in the tests. Among the soft white winter wheats this variety is of outstanding merit. It is one of the most popular varieties of winter wheat in the eastern United States. At Arlington it ranks third in average yield in a 5-year test and is first in yield of the awnless varieties. At College Park, however, it has not yielded so well, ranking eighteenth in average yield per acre among the 29 varieties that have been tested seven years. Two strains of this variety have been included in the tests at College Park.

HIGH-YIELDING VARIETIES.

The varieties which have been high in yield at College Park have not always been high in yield at Arlington, and vice versa. This is well shown in Table V, in which the average yields of the 10 best varieties at each place are shown, with the records of the same varieties at the other place for comparison. The integers in the columns headed "Rank" denote the rank of the variety among the total number in the test. The denominators of the fractions in these columns show the number of varieties grown in the same years as the variety in question, while the numerator shows the rank of that variety. Thus the China was grown only two years at Arlington, when it ranked thirty-second among 36 varieties that were grown the same two years.

Of the 82 varieties and strains which have been grown at College Park, the 10 highest in order of yield, as shown in Table V, are (1) China, (2) Mammoth Red, (3) Bearded Purple Straw, (4) Turkish Amber, (5) Lancaster, (6) Currell, (7) Bearded Winter Fife, (8) Dietz (C. I. No. 1981), (9) Red Clawson, and (10) Dietz (Md. No. 95). The difference in the 7-year average yield of China and Dietz (Md. No. 95) is 2.46 bushels. Of these 10 varieties, 9 are soft red and 1 (Bearded Winter Fife) is a white wheat. Of the red wheats, 6 (Nos. 2, 3, 4, 5, 8, and 10) are bearded, with glabrous white chaff; 3 (Nos. 1, 6, and 9), are beardless, with glabrous brown chaff. The one white-kerneled variety is bearded, with hairy white chaff. Of the 10

varieties, 7 are bearded and 3 beardless; 7 are white chaffed and 3 brown chaffed; and 9 have glabrous (smooth) and 1 pubescent (velvet) chaff.

TABLE V.—*The ten highest yielding varieties of wheat at the Maryland Agricultural Experiment Station (College Park) and at Arlington Farm, Va., arranged in order of yield, with the record of each in both locations.*

[The numerators of fractions in the columns headed "Rank" denote the rank of the variety for the years grown; the denominators indicate the number of varieties grown in those years.]

Name.	C. I. No.	Md. No.	At College Park.			At Arlington Farm.		
			Rank.	Number of years grown.	Average yield.	Rank.	Number of years grown.	Average yield.
College Park:								
China	.....	194	1	7	31.17	$\frac{3}{3}$	2	20.90
Mammoth Red	2008	.....	2	7	31.09	$\frac{8}{23}$	5	27.41
Bearded Purple Straw	1911	.....	3	7	30.95	$\frac{1}{23}$	5	23.86
Turkish Amber	.....	195	4	7	30.11	.....	.....	.....
Lancaster	1945	.....	5	7	30.03	$\frac{2}{23}$	5	29.74
Currell	.....	89	6	7	29.62	$\frac{1}{23}$	2	25.25
Bearded Winter Fife	1942	.....	7	7	29.56	$\frac{17}{23}$	5	28.24
Dietz (Dietz Longberry)	1981	.....	8	7	29.53	$\frac{11}{23}$	5	26.87
Red Clawson	.....	188	9	7	28.92	.....	.....	.....
Dietz	.....	95	10	7	28.71	.....	.....	.....
Arlington Farm:								
Purple Straw	1915	.....	$\frac{23}{40}$	5	25.39	1	5	32.09
Lancaster	1945	.....	$\frac{5}{39}$	7	30.03	2	5	29.74
Dawson	1733	.....	$\frac{18}{39}$	7	27.17	3	5	29.37
Fultz	1923	.....	$\frac{22}{26}$	7	25.92	4	5	29.17
Purple Straw	1957	.....	.....	.....	.....	5	5	29.08
Poole	1979	.....	$\frac{16}{40}$	4	29.22	6	5	28.74
Bearded Winter Fife	1942	.....	$\frac{7}{26}$	7	29.56	7	5	28.24
Stoner	2980	358	$\frac{3}{3}$	3	25.47	8	4	27.42
Mammoth Red	2008	.....	$\frac{9}{26}$	7	31.09	9	5	27.41
Rocky Mountain	1930	.....	$\frac{10}{40}$	5	26.66	10	5	27.33

Of the 43 varieties and strains grown at Arlington, the 10 highest in order of yield (Table V) are (1) Purple Straw (C. I. No. 1915), (2) Lancaster, (3) Dawson, (4) Fultz, (5) Purple Straw (C. I. No. 1957), (6) Poole, (7) Bearded Winter Fife, (8) Stoner, (9) Mammoth Red, and (10) Rocky Mountain. The difference in the 5-year average yield between Purple Straw (C. I. No. 1915) and Rocky Mountain is 4.76 bushels. Of these 10 varieties, 8 have red grains and 2 (Nos. 3 and 7) have white grains. Of the red-grained varieties, 3 (Nos. 1, 4, and 5) are beardless, with glabrous white chaff; 3 (Nos. 2, 8, and 9) are bearded, with glabrous white chaff; 1 (No. 6) is beardless, with glabrous brown chaff; and 1 (No. 10) is bearded, with glabrous brown chaff. Of the two white-grained varieties, 1 (No. 3) is beardless, with glabrous brown chaff, and 1 (No. 7) is bearded, with hairy white chaff. Of the 10 varieties, 5 are bearded and 5 beardless; 7 are white chaffed and 3 are brown chaffed; and 9 have glabrous and 1 hairy chaff.

The Lancaster, Mammoth Red, and Bearded Winter Fife are the only varieties which appear among the 10 best at both College Park and Arlington. Of the other 7 among the 10 best at College Park the China has been grown only 2 years at Arlington and has been low in yield in both; Bearded Purple Straw has been eighteenth and Dietz

(Dietz Longberry) eleventh of 22 varieties grown in all 5 years; Currell has been grown only 2 years, with only a fair average yield; and Turkish Amber, Red Clawson, and Dietz (Md. No. 95) have not been included in the tests at Arlington. Of the remaining 7 in the 10 best at Arlington, Poole (C. I. No. 1979) was discarded at College Park in 1911 and Purple Straw and Rocky Mountain in 1912; Dawson is eighteenth and Fultz twenty-second among the 29 varieties grown all 7 years; Stoner has been grown only 3 years, with fair yields; and Purple Straw (C. I. No. 1957) has not been included in the tests at College Park.

TESTS OF SELECTIONS IN FIELD PLATS.

Many selections have been made from some of the leading varieties of winter wheat, the object being to develop superior strains. While the nursery work along this line has been rather extensive at both College Park and Arlington Farm, the number of pure lines that have been tested in field plats in comparison with the old strains is comparatively small. At College Park several of the high-yielding pure lines of the Fultz and Currell varieties were sown in twentieth-acre plats in the fall of 1910. Plats containing a mixture of a half dozen or more pure lines of each variety also were sown, as well as plats of the original unselected varieties for checks. Unfortunately, the Currell checks were not continued after 1911, so that only the yields of Currell in the regular varietal test in another field are available for comparison. The annual and average yields of these selections and of the original unselected varieties at College Park from 1911 to 1914 are shown in Table VI. At Arlington Farm pure-line selections were tested in field plats only in 1913 and 1914, so that data of sufficient value to report have not yet been obtained.

TABLE VI.—*Annual and average yields of pure lines of Fultz and Currell winter wheats at the Maryland Agricultural Experiment Station (College Park), 1911 to 1914, inclusive, with yields of the unselected varieties for comparison.*

Variety and strain.	Yield per acre (bushels).				
	1911	1912	1913	1914	Average.
Fultz (C. I. No. 1923 and Md. No. 84):					
Original stock	38.60	18.20	24.27	30.33	27.85
Mixture of pure lines	37.60	19.37	22.80	36.07	28.96
Plat 35 (1909 B. P.)[1]	36.33	24.20	21.83	34.67	26.76
Plat 42 (1909 B. P.)	37.10	25.07	22.67	34.67	29.88
Plat 29 (1909 B. P.)	38.70	22.57	24.07	29.67	28.75
Original stock	35.73	26.77	22.00	27.67	28.04
Currell (C. I. No. 3326 and Md. No. 89):					
Original stock	35.10	[2]20.20	[2]22.10	[2]41.87	29.82
Mixture of pure lines	36.87	29.87	23.33	28.87	29.74
Plat 7 (1909 B. P.)	37.43	28.70	23.57	32.00	30.43
Plat 5 (1909 B. P.)	38.47	26.07	24.57	[3]	29.70
Plat 13 (1909 B. P.)	35.03	30.73	25.47	29.77	30.25
Original stock	36.23	.....	.....	.....	.....

[1] Breeding plat of 1909.
[2] Not comparable; grown in a different field. The Currell checks were discontinued after 1911.
[3] Discontinued.

Table VI shows that two of the three pure lines of Fultz have given higher average yields for the four years than the original stock, one of them exceeding the original variety by nearly 2 bushels. The mixture of good pure lines has also exceeded the unselected original stock in average yield by about 1 bushel. In the one year (1911) when comparable yields of unselected Currell were obtained, two of the selections and the mixture of pure lines exceeded the original stock in yield. For the four years, the two pure lines which have been continued exceeded the mixture of pure lines by about one-half bushel. They have also exceeded the original stock, but, as previously stated, these yields are not really comparable.

From these results it appears that slight gains in yield are to be obtained by the selection of pure lines, even though, as in the present case, the original varieties apparently are quite pure.

RATE-OF-SEEDING TEST.

A test to determine the best rate of seeding for wheat was begun at Arlington Farm in 1911. Three varieties, Dietz (Dietz Longberry), Fultz, and Fulcaster (Acme), were sown at the rates of 4, 5, and 6 pecks each. In 1912 five additional varieties, Stoner, Martin Amber, Missouri Bluestem, Kharkof, and Purple Straw (C. I. No. 1957), were added to the test, the rates of seeding being the same as in the previous year. In 1913 and 1914 only four varieties, Dietz, Fultz, Stoner, and Martin Amber, were included; but the rates of seeding were increased to include 2, 3, 7, and 8 pecks. In 1911 and 1912 single twentieth-acre plats of each variety at each rate were sown. In 1913 and 1914 the tests were conducted in duplicate on fortieth-acre plats. The yields of grain from each variety at the different rates of seeding are shown in Table VII.

Table VII shows that the highest yield of the Dietz wheat for the four years from 1911 to 1914 was obtained from the 4-peck rate of seeding and the highest yield of the Fultz from the 5-peck rate. Only the 4, 5, and 6 peck rates were included in the test during all the years. The Stoner and Martin Amber wheats were sown at the 4, 5, and 6 peck rates in the three years from 1912 to 1914. Both these varieties have given slightly higher yields from the 4-peck rate than from either the 5-peck or 6-peck rate. The other varieties which were grown only in 1911 and 1912 vary but slightly in yield from the different rates of seeding.

The average for all varieties which have been grown at the 4, 5, and 6 peck rates from 1911 to 1914 shows a yield of 28.75 bushels from the 4-peck rate, 27.86 bushels from the 5-peck rate, and 26.45 bushels from the 6-peck rate. When the yields are shown on a strictly comparable basis by subtracting the quantity sown in each case from the average yield, the advantage of the lower rate is still further increased. The net average yield from the 4-peck rate is 27.75 bushels; from the 5-peck rate, 26.61 bushels; and from the 6-peck rate, 24.95 bushels.

Of the four varieties which were grown at rates of 2, 3, 4, 5, 6, 7, and 8 pecks in 1913 and 1914, the Dietz gave the highest yield from the 8-peck, the Fultz and Stoner from the 4-peck, and the Martin Amber from the 3-peck rate. The differences in yield from the various rates are slight, however, except that the 2-peck rate has given consistently lower yields.

TABLE VII.—*Annual and average yields per acre (bushels) obtained in a rate-of-seeding test with eight varieties of winter wheat at Arlington Farm, Va., 1911 to 1914, inclusive.*

Variety and year.	Rate of seeding (pecks per acre).						
	2	3	4	5	6	7	8
Dietz (Dietz Longberry), C. I. No. 1981:							
1911	.....	.....	31.30	21.40	13.80	.....	.....
1912	.....	.....	28.00	24.50	22.67	.....	.....
1913	18.90	19.90	16.80	18.70	19.40	17.40	16.70
1914	26.70	30.00	29.50	27.80	29.70	30.60	32.50
Average, 1913–14	22.80	24.95	23.15	23.25	24.55	24.00	26.10
Net average, 1913–14 [1]	22.30	24.20	22.15	22.00	23.05	22.25	24.10
Average, 1911–1914	.....	.....	26.40	23.10	22.64	.....	.....
Net average, 1911–1914	.....	.....	25.40	21.85	21.14	.....	.....
Fultz, C. I. No. 1923:							
1911	.....	.....	19.10	24.80	24.10	.....	.....
1912	.....	.....	32.55	32.42	31.22	.....	.....
1913	19.10	22.70	24.70	24.60	24.00	21.30	24.80
1914	29.70	33.00	39.00	37.70	36.20	37.40	37.90
Average, 1913–14	24.40	27.85	31.85	31.15	30.10	29.35	31.35
Net average, 1913–14	23.90	27.10	30.85	29.90	28.60	27.60	29.35
Average, 1911–1914	.....	.....	28.84	29.88	28.88	.....	.....
Net average, 1911–1914	.....	.....	27.84	28.63	27.38	.....	.....
Stoner (Miracle), C. I. No. 2980:							
1912	.....	.....	29.67	32.22	30.17	.....	.....
1913	17.40	18.30	17.10	17.50	14.70	14.50	16.00
1914	26.90	30.70	32.80	28.90	29.70	30.90	29.80
Average, 1913–14	22.15	24.50	24.95	23.20	22.20	22.70	22.90
Net average, 1913–14	21.65	23.75	23.95	21.95	20.70	20.95	20.90
Average, 1912–1914	.....	.....	26.52	26.21	24.86	.....	.....
Net average, 1912–1914	.....	.....	25.52	24.96	23.36	.....	.....
Martin Amber, C. I. No. 1974:							
1912	.....	.....	34.92	31.83	28.83	.....	.....
1913	18.40	19.70	19.00	17.20	17.40	12.40	14.70
1914	22.60	27.00	26.00	24.90	27.80	25.60	23.90
Average, 1913–14	20.50	23.35	22.50	21.05	22.60	19.00	19.30
Net average, 1913–14	20.00	22.60	21.50	19.80	21.10	17.25	17.30
Average, 1912–1914	.....	.....	26.64	24.64	24.68	.....	.....
Net average, 1912–1914	.....	.....	25.64	23.39	21.10	.....	.....
Fulcaster (Acme), C. I. No. 3115:							
1911	.....	.....	21.30	23.70	19.70	.....	.....
1912	.....	.....	26.87	25.87	24.33	.....	.....
Average	.....	.....	24.09	24.79	22.02	.....	.....
Purple Straw, C. I. No. 1957:							
1912	.....	.....	29.67	29.25	28.78	.....	.....
Missouri Bluestem, C. I. No. 1912:							
1912	.....	.....	27.67	25.07	23.33	.....	.....
Kharkof, C. I. No. 3615:							
1912	.....	.....	20.67	22.50	22.27	.....	.....
Summary of averages:							
3 varieties in 1911	.....	.....	23.90	23.30	20.87	.....	.....
8 varieties in 1912	.....	.....	25.56	24.85	23.51	.....	.....
4 varieties in 1913	18.45	20.15	19.40	19.50	18.37	16.40	18.80
4 varieties in 1914	26.47	30.17	31.82	29.82	30.85	31.12	31.02
All trials, 1913–14	22.46	25.16	25.61	24.66	24.61	23.76	24.91
Net average, 1913–14	21.96	24.41	24.61	23.41	23.11	22.01	22.91
All trials, 1911–1914	.....	.....	28.75	27.86	26.45	.....	.....
Net average, 1911–1914	.....	.....	27.75	26.61	24.95	.....	.....

[1] Actual yield less the quantity sown.

When the difference in the rate of seeding is considered, the net yields of the Dietz from the 3-peck and 8-peck rates were practically the same, 24.20 and 24.10 bushels, respectively, with the other rates of seeding averaging from 1 to 2 bushels lower. The net yields of the Fultz show that the 4-peck rate gave the best average result, 30.85 bushels, with a consistent reduction when less or more seed was sown, except that the 8-peck rate gave a higher net yield than any of the others except the 4-peck and 5-peck rates.

The Stoner gave the highest net yields from the 3-peck and 4-peck rates, 23.75 and 23.95 bushels, respectively. The net yields from the other rates of seeding were from 2 to 3 bushels lower. The highest net yield from Martin Amber, 22.6 bushels, was obtained from the 3-peck rate, with decidedly lower net yields from all the other rates except the 4-peck.

The average for all four varieties which were grown at the seven rates of seeding in 1913 and 1914 show slightly higher net yields from the 3-peck and 4-peck rates than from any of the others. The net average yields from these rates are 24.41 and 24.61 bushels, respectively. There is a constant reduction in the average net yield from higher and lower rates of seeding, except that the 8-peck rate gives a yield of 0.9 bushel higher than the 7-peck rate.

Although these tests have not been conducted long enough for the data to be conclusive, it appears that quite as good or perhaps slightly better yields may be obtained when wheat is sown at the rate of 3 or 4 pecks on fertile, well-prepared land than when sown at rates ranging from 5 to 8 pecks to the acre. As there is a decided saving of seed at the lower rates, these are to be preferred where conditions are similar to those existing on the Arlington Farm. It is not known how widely these results are applicable.

EXPERIMENTS WITH WINTER SPELT AND EMMER.

Spelt and emmer are closely related to wheat, but the spikelets do not break up in thrashing, as in wheat, the kernel remaining inclosed in the glumes. When the glumes are removed, the kernel is quite similar to that of wheat, not only in appearance but in composition. These grains are used chiefly as feed for domestic animals. Because the inclosing glumes give considerable bulk to the grain, the feeding value of spelt and emmer is about the same as that of oats or barley. These grains, particularly spelt, are not grown as generally in the South Atlantic States as experimental results seem to warrant.

Varietal tests of spelt and emmer have been conducted at College Park since 1908 and at Arlington since 1910. The tests at College Park have included five varieties of spelt and two varieties and one selection of emmer. Only two varieties of spelt, one of emmer, and the emmer selection, however, have been grown for the entire six

years from 1909 to 1914. At Arlington the tests have included four varieties and selections of spelt, one variety of emmer, and one emmer selection.

TABLE VIII.—*Tests of winter spelt and emmer at the Maryland Agricultural Experiment Station (College Park) and at Arlington Farm, Va., for the years stated.*

ANNUAL AND AVERAGE YIELDS.

Crop and variety.	C. I. No.	Yield per acre (bushels).[1]						
		1909	1910	1911	1912	1913	1914	Average.
AT COLLEGE PARK.								
Spelt:								
Alstroum	1773	52.53	59.27	70.27	69.73	54.27	73.33	63.23
Red Awnless	1772	43.07	61.87	66.27	72.00	66.13	69.73	63.18
Servia	1724	54.50	53.73	.....	.....	.....	.....	.....
Do	[2] 1774	22.67	48.20	.....	.....	.....	.....	.....
White Bearded	2481	52.57	50.00	.....	.....	.....	.....	.....
Emmer:								
Black Winter	2337	21.07	35.80	45.20	32.00	36.80	48.53	36.57
Black Winter selection	2337–1	21.47	33.47	47.07	36.67	34.13	[3] 18.93	31.96
White	2101	12.53	30.80	.....	.....	.....	.....	.....
AT ARLINGTON FARM.								
Spelt:								
Alstroum	1773	.....	88.00	50.67	78.20	51.33	102.20	74.08
Alstroum selection [4]	3264	.....	.....	48.00	89.67	49.33	107.30	73.56
Red Awnless	1772	.....	85.33	45.00	79.80	54.00	97.10	72.26
Servia	1724	.....	57.00	40.67	74.67	48.33	87.20	61.69
Emmer:								
Black Winter	2337	.....	34.33	11.67	30.67	20.50	14.50	22.33
Black Winter selection	2337–1	.....	36.67	19.87	34.67	([5])	.....	.....

MISCELLANEOUS DATA FOR THE PRINCIPAL VARIETIES FOR PERIODS OF FOUR TO SIX YEARS.

Crop and variety.	C. I. No.	Number of years grown.	Average date—		Average height.	Average yield per acre.		Average weight per measured bushel.
			Heading.	Ripe.		Grain.[1]	Straw.	
AT COLLEGE PARK.					*In.*	*Bush.*	*Lbs.*	*Lbs.*
Spelt:								
Alstroum	1773	6	[6] May 23	[6] June 23	42	63.23	[6] 2,950	24.8
Red Awnless	1772	6	...do....	[6] June 22	41	63.18	[6] 3,030	24.0
Emmer:								
Black Winter	2337	6	[7] May 31	[8] June 28	45	36.57	[6] 2,080	21.0
Black Winter selection	2337–1	6	...do....	[8] June 27	45	31.96	[6] 1,950	21.0
AT ARLINGTON FARM.								
Spelt:								
Alstroum	1773	5	May 26	June 23	41	74.08	3,100	30.5
Alstroum selection	3264	4	May 28	June 22	41	73.56	3,510	29.0
Red Awnless	1772	5	May 26	...do....	43	72.26	3,280	29.6
Servia	1724	5	...do....	...do....	43	61.69	3,290	26.9
Emmer:								
Black Winter	2337	5	May 31	June 26	41	22.33	1,940	25.5

[1] Bushels of 30 pounds each.
[2] Identical with Servia, C. I. No. 1724.
[3] The low yield was due to a poor stand.
[4] Identical with Alstroum, C. I. No. 1773.
[5] Accidentally mixed with original strain in thrashing.
[6] Data for five years only.
[7] Data for three years only.
[8] Data for four years only.

The methods of growing winter spelt and emmer are the same as for wheat. The date of seeding at College Park and Arlington has varied from October 5 to 15, the same dates as for winter wheat. The rate of seeding at both points has ranged from 8 to 12 pecks (60 to 90 pounds) per acre. These grains are rather difficult to sow with the ordinary drill, because of their bulky nature. The usual method has been to set the drill to sow about twice the quantity of seed that was really desired: that is, in order to sow 8 pecks per acre it was necessary to set the drill to sow 16 pecks.

Table VIII shows the annual and average yields in bushels of 30 pounds each of the spelts and emmers at College Park and at Arlington Farm, respectively. The average dates of heading and of maturity, height, yield of grain and of straw, and weight per bushel for the principal varieties at both localities are also shown.

Table VIII shows that decidedly better yields of spelt than of emmer have been obtained at both College Park and at Arlington Farm. The yields of spelt have been considerably higher at Arlington Farm than at College Park, while the yields of emmer at College Park have been higher than at Arlington Farm.

Table VIII also shows that spelt matures about June 22, or at the same time as wheat, and that emmer matures about 4 or 5 days later. The average height of plants of both spelt and emmer is about 3½ feet. The proportion of grain to straw is much greater than in wheat, but if the hull is removed from the kernel it is about the same as that of wheat. Owing to the large proportion of hull the weight per bushel is quite low. The average weight per bushel of emmer has been from 3 to 5 pounds less than that of spelt. The weight per bushel in each varies considerably from year to year, due to the fact that in some years a much greater proportion of the kernels thrashes free from the hull than in others.

These grains are very resistant to both stem and leaf rust; in fact, they are much more resistant to these diseases than wheat, oats, and barley. Of the two, emmer is believed to be the more resistant. No smut has ever been noted on spelt or emmer at either College Park or Arlington Farm.

LEADING VARIETIES.

The Alstroum, Red Awnless, and Servia spelts and the Black Winter emmer are the principal varieties of these grains which have been included in the tests at both College Park and Arlington Farm. Heads of all these varieties are shown in figure 3.

SPELT.

Alstroum.—The Alstroum spelt, C. I. No. 1773, was obtained by the Office of Cereal Investigations in 1901 from the Washington Agricultural Experiment Station, Pullman, Wash. This station intro-

duced it originally from Asia. It is an awnless, white-glumed, very stiff strawed variety. The head is 2½ to 3 inches in length, erect, much more slender than that of wheat, and very compact. This variety has averaged 63.23 bushels to the acre in a 6-year test at College Park and 74.08 bushels in a 5-year test at Arlington Farm. It has given a higher average yield at both places than any other variety of spelt or emmer. A selection from Alstroum has been grown at Arlington Farm for 4 years, during which time it had an average yield 3 bushels higher than that of the original variety.

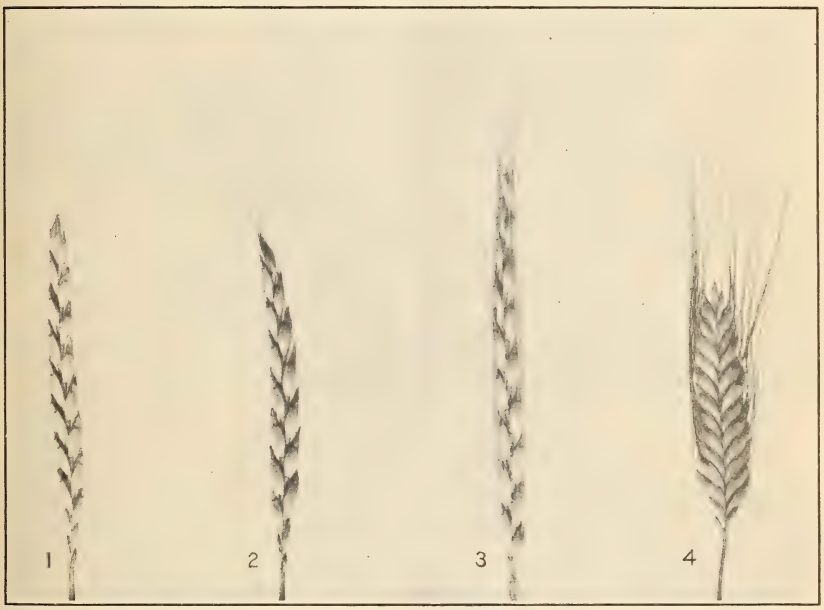

FIG. 3.—Heads of three varieties of spelt and one variety of emmer grown at the Maryland Agricultural Experiment Station and at Arlington Farm: 1, Alstroum spelt; 2, Red Awnless spelt; 3, Servia spelt; 4, Black Winter emmer.

Red Awnless.—The Red Awnless spelt, C. I. No. 1772, was also obtained by the Office of Cereal Investigations in 1901 from the Washington station. Like the Alstroum, it came originally from Asia. It is very similar to the Alstroum, except that the glumes are brownish red in color; hence the name. The average yield of the Red Awnless spelt was 0.05 bushel less than that of Alstroum at College Park and 1.82 bushels less at Arlington Farm.

Servia.—The Servia or "White Bearded" spelt, C. I. No. 1724, came originally from Serbia; hence the name. This variety was obtained at the Paris Exposition in 1900 by Mr. M. A. Carleton, Cerealist of the United States Department of Agriculture. This spelt is not unlike the Alstroum in appearance, except that it is bearded. The heads are slightly longer than those of the awnless varieties and

are less erect. The awns are slender, medium long, and very stiff. This character renders it more or less unpleasant to harvest and thrash. The average yield of the Servia spelt in a 5-year test at Arlington Farm was 12.39 bushels less than that of the Alstroum. This variety was discarded at College Park after a 2-year trial.

EMMER.

Black Winter.—The Black Winter emmer,[1] C. I. No. 2337, which has been grown in field plats at College Park and Arlington Farm was obtained in 1904 from a seed firm in Paris. Several earlier importations were grown in nursery rows only. The plant and head characters of emmer are quite different from those of spelt. The whole plant is larger, the leaves are wider, and the stem is larger in diameter. In the Black Winter (Black Velvet Winter) the heads are of a grayish black, velvety appearance; hence the name. The heads are quite large, bearded, compact, and much flattened. The awns are very long, heavy, and spreading. The yields of winter emmer at College Park have invariably been lower than those of spelt, the average for six years being 36.57 bushels as compared with 63.23 bushels for Alstroum spelt. A much greater difference in favor of spelt has been recorded at Arlington Farm, where the average yields were 22.33 bushels for emmer and 74.08 bushels for spelt.

EXPERIMENTS WITH WINTER RYE.

A varietal test of winter rye has been conducted at Arlington Farm since 1911. The rye varieties have not been grown in adjoining plats, but have been interspersed at more or less definite intervals throughout the series of wheat varietal plats. By this method the danger of cross-pollination among the rye varieties was greatly reduced. The test at Arlington Farm has included 12 varieties and selections of winter rye. No tests have been conducted at College Park.

The date of seeding for winter rye has varied from October 5 to 15. This is earlier than rye is usually sown in farm practice. However, the high yields that have been obtained each year by early sowing seem to indicate that the crop is usually sown too late to insure the best results. All varieties have been sown at the rate of 6 pecks to the acre.

The annual and average yields of these 12 varieties and selections for the four years from 1911 to 1914, inclusive, are shown in Table IX. The average dates of heading and of maturity, height, yield of grain and of straw, and weight per bushel for these varieties are also shown.

[1] For a more complete discussion of winter emmer, see Carleton, M. A., Winter emmer, U. S. Dept. Agr. Farmers' Bul. 466, 24 p., 8 fig., 1911.

TABLE IX.—*Tests of twelve varieties and selections of winter rye grown at Arlington Farm, Va., 1911 to 1914, inclusive.*

ANNUAL AND AVERAGE YIELDS.

Variety.	C. I. No.	Yield per acre (bushels).					
		1911	1912	1913	1914	Average.	
						1911–1914	1912–1914
Giant Winter[1]	30	21.70	37.45	36.30	36.10	32.89	36.62
Virginia Winter	128	24.30	31.61	27.20	38.60	30.43	32.47
Rimpau	126	22.30	35.84	25.70	35.50	29.34	31.68
Arlington Winter	127	15.60	32.68	26.80	41.10	29.05	33.53
Giant Winter[2]	30	23.80	23.93	29.50	35.70	28.23	29.71
Mexican	108	14.30	35.54	28.20	31.80	27.46	31.85
Spring[3]	73	5.50	30.59	36.10	35.50	26.92	34.06
Ivanof	34	12.30	37.68	21.40	34.50	26.47	31.19
Abruzzes	40	.....	34.56	37.90	35.20	.....	35.89
Henry	138	.....	32.00	34.30	26.80	.....	31.03
Giant Winter selection	30	.....	31.64	24.60	30.00	.....	28.75
Rimpau selection	126	.....	33.72	[4]38.00	.....	.....	.....

MISCELLANEOUS DATA.

Variety.	C. I. No.	Number of years grown.	Average dates—		Average height.	Average yield per acre.		Average weight per bushel.
			Headed.	Ripe.		Grain.	Straw.	
					Inches.	*Bushels.*	*Pounds.*	*Pounds.*
Giant Winter[1]	30	4	May 7	June 18	59	32.89	3,700	55.1
Virginia Winter	128	4	May 5	...do....	61	30.43	3,570	54.6
Rimpau	126	4	May 12	June 26	57	29.34	4,250	52.8
Arlington Winter	127	4	May 7	June 20	62	29.05	4,350	55.4
Giant Winter[2]	30	4	May 6	June 21	58	28.23	3,730	53.9
Mexican	108	4	May 1	June 16	59	27.46	3,560	54.9
Spring[3]	73	4	May 5	June 18	58	26.92	3,360	55.5
Ivanof	34	4	...do....	June 19	58	26.47	2,990	54.4
Abruzzes	40	3	Apr. 28	June 16	63	35.89	4,660	54.7
Henry	138	3	Apr. 29	June 17	62	31.03	[5]4,870	54.3
Giant Winter selection	30	3	May 3	June 20	60	28.75	3,710	54.3
Rimpau selection	126	2	May 11	June 27	57	35.86	[6]3,150	53.0

[1] California strain.
[2] Native strain.
[3] Grown prior to 1911 as a spring variety.
[4] Not comparable because of abnormal soil conditions.
[5] Data for 2 years only.
[6] Data for 1 year only.

As shown in Table IX, Giant Winter, C. I. No. 30, is the leading variety in yield of those tested four years. The Abruzzes, C. I. No. 40, which has been grown only three years, is only slightly lower in yield than the Giant Winter for that period (fig. 4). The lowest average yield for the four years was obtained from the Ivanof, C. I. No. 34. The differences in yield are slight, however, and a test for a longer period may show a quite different ranking.

According to the data in Table IX, the period between heading and ripening in rye is about 6 weeks. This is about 2 weeks longer than in wheat. The average date of heading in the 12 varieties and selections has varied from April 28 to May 12 and the average time of ripening from June 16 to 27. The average height of the plants has been about 5 feet. The average yield of straw of those tested four years has varied from 2,990 to 4,350 pounds. The data on yield

of grain and straw indicate that the proportion of grain to straw in rye is somewhat less than in wheat. The average weight per bushel has been about 1½ pounds below the standard, with little variation between individual varieties.

LEADING VARIETIES.

The number of distinct varieties of rye is quite small. A large number of the so-called varieties have no particular distinguishing characters. It has been found at Arlington Farm that the several distinct varieties are becoming harder to recognize from year to year, despite the precautions that are taken to prevent cross-pollination.

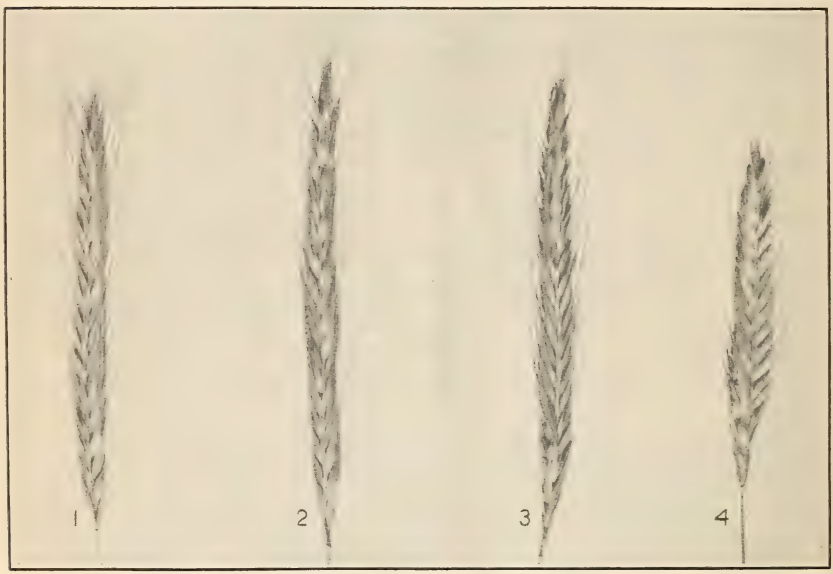

FIG. 4.—Heads of four varieties of winter rye grown at Arlington Farm: 1, Giant Winter; 2, Virginia Winter; 3, Abruzzes; 4, Henry.

It is believed that eventually it will become necessary to discontinue all but the one variety that possesses the most desirable characters and then improve this one isolated variety. The different varieties grown at Arlington Farm during the past four years are all of more or less promise. For this reason the origin and a brief mention of each are given in the following paragraphs.

Giant Winter.—The Giant Winter rye, C. I. No. 30, was obtained from France through the Office of Foreign Seed and Plant Introduction in 1902. The three strains of this variety in Table IX are all from the same original stock. The California strain was obtained from that State in 1910, in order to compare it with the strain which had been grown continuously in the East since the importation of

the variety. In a 4-year test, the strain previously grown in California for eight years has outyielded the eastern-grown strain by slightly more than 4 bushels. Whether this increased yield was due entirely to the fact that it had been grown under California conditions for several years the writer can not say.

The Giant Winter selection was developed from an individual head selected at Arlington Farm. In a 3-year test it has given a lower average yield than the old strain. The Giant Winter is a very tall, large, and vigorous stiff-strawed variety. The heads are medium long, slightly flattened, compact, and tapering more or less toward the apex. The kernels are long, fairly plump, and of a brownish yellow color.

The Virginia Winter, C. I. No. 128, and Arlington Winter, C. I. No. 127, are very similar to the Giant Winter. The former is a pedigreed strain that has been developed at Arlington, while the latter is a mass selection from a commercial variety that is grown extensively on the Arlington Farm for green-manuring purposes. Both have produced very satisfactory yields. The variety C. I. No. 73, originally a spring rye, is also quite similar to Giant Winter. This variety was obtained from Mr. F. W. Boehme, Geneva, Idaho. Only about 15 per cent of the plants survived the winter the first year it was sown at Arlington Farm. The next year and thereafter it behaved as a true winter variety. It is quite possible that the seed that was sown the first year contained a mixture of a winter rye, which accounted for the few plants that did not winterkill. The yield of this rye in succeeding years compared favorably with that of the other varieties.

Abruzzes.—The Abruzzes or Abruzzi rye, C. I. No. 40, was introduced into the United States from San Giovanni a Teduccio, near Naples, Italy, in 1904. This rye does not differ greatly in appearance from most of the varieties previously mentioned, yet when pure it can usually be recognized readily. It is the tallest of all the varieties that have been tested at Arlington Farm. The heads are long, nearly square, and well developed. They are less tapering than in most ryes, holding their width until quite near the tip. The kernels are large, plump, and of a dark-brown color. The quality of grain in this variety is probably the best of any that have been grown at Arlington Farm. Because of its tall, slender straw the Abruzzes is quite likely to lodge when grown on rich land. This variety is becoming quite popular in many sections in the South Atlantic States.

Mexican.—The Mexican variety, C. I. No. 108, was obtained from Tlaxcala, Mexico. In general appearance it is quite similar to the Giant or Virginia Winter type. However, the whole plant is less

vigorous, the stems are more slender, and the heads and kernels are both smaller. The kernels are yellow in color and usually quite well developed.

Ivanof.—The Ivanof rye, C. I. No. 34, was introduced into this country from Russia by Prof. N. E. Hansen in 1898. In general appearance and plant characters it is practically the same as the Mexican.

Rimpau.—The Rimpau rye, C. I. No. 126, was introduced from Germany in 1910. The seed was purchased from Mr. W. Rimpau, a noted German cereal breeder, Schlansted, Saxony, and was known as "Old Breeding." It is a rather more distinct variety than any of those previously mentioned. It is decidedly the latest maturing rye included in the tests at Arlington. The leaves are much broader than those of other varieties. Because of this character it is more frequently recommended than others where a hay variety is desired. The heads are drooping, very large, nearly square, and are borne upon a large but not very stiff straw. The kernels are medium long, broad, shrunken, and blue in color. The quality of grain in the Rimpau variety is inferior to that of any other included in the trials at Arlington. The shrunken condition of the kernel is apparently due more to an inherent characteristic of the variety than to environment.

The Rimpau selection is a pure line of this variety which was selected at Arlington Farm with the intention of improving the quality of grain, although no marked improvement was effected. The straw of this particular strain was quite weak, and for this reason it was discontinued.

Henry.—The original source of the Henry rye, C. I. No. 138, is not known. This rye when pure is quite different in appearance from any other here discussed and it usually can be identified readily. The heads are short and very broad at the base, giving them a spear-shaped appearance. The kernels are quite similar to those of the Abruzzes, except that they are a little lighter brown in color. In yield the Henry rye has been less satisfactory than the Giant or Virginia Winter.

EXPERIMENTS WITH WINTER OATS.

Fall-sown oats succeed much better than spring oats in southern and eastern Maryland and in Virginia east of the Blue Ridge. Spring-sown oats give fairly good results in particularly favorable seasons, but the crop is not at all a reliable one. Therefore, most of the experimental work that has been done at College Park and Arlington Farm with oats has been with fall-sown varieties.

Varietal tests of winter oats have been conducted in field plats at College Park since 1908 and at Arlington Farm since 1911. Prior to 1911 this crop was grown only in the nursery at Arlington Farm. The trials at College Park during the seven years have included 13

varieties and selections, of which only 5 have been grown since 1911. At Arlington Farm 19 varieties and selections have been included, of which 14 are still grown.

The varietal tests of winter oats at College Park have been sown on the following dates: October 16, 1907; October 9, 1908; September 29, 1909; October 9, 1910; September 20, 1911; October 1, 1912; and Octotober 4, 1913. At Arlington Farm the dates were September 23, 1910; September 8, 1911; September 11 and 14, 1912; and September 29 and 30, 1913. The average date of seeding at College Park has been a little more than 2 weeks later than at Arlington Farm. Experience has shown that in most years the date of seeding at Arlington Farm has been too early for the best results. It is believed that if the seeding of winter oats is delayed until late September or early October in this locality, more satisfactory yields usually will be obtained. At higher altitudes than Washington, D. C., earlier seeding is advisable.

The rate of seeding at College Park was 10 pecks in 1908, 1910, 1911, and 1912; 10½ pecks in 1909; and 8 pecks in 1913 and 1914. No attention was given to size of kernel in determining the rate of seeding for the several varieties. At Arlington Farm in 1911 the Winter Turf was sown at the rate of 8 pecks, the Bicknell and Culberson at the rate of 10 pecks, and the Red Rustproof at the rate of 14 pecks. In the succeeding years the 8-peck rate was used for all varieties except the Red Rustproof, which was sown at the rate of 12 pecks. These rates have been found quite satisfactory, although it is believed that a rate of 6 pecks is ample for the Winter Turf. The kernels of this variety are small and the plants are hardier and stool more freely than those of the other varieties; hence, less seed is required.

The low yields obtained from most of the varieties and selections grown at Arlington Farm in 1912 were directly due to winterkilling, a minimum temperature of −13° F. having been recorded. Thus, the yields of that year are a fair index of the relative hardiness of the several varieties and selections.

The annual and average yields per acre, in bushels of 32 pounds each, of the varieties and selections included in these tests are presented in Table X.

The Winter Turf, C. I. No. 180, has produced the highest average yield, 51.3 bushels, in the 7-year test at College Park. The Winter Turf selection, C. I. No. 274–1, ranks second, with an average of 48.37 bushels, and the Culberson, C. I. No. 273, third, with 46.3 bushels. The Bicknell, C. I. No. 206, which has been grown only six years (1909–1914), has an average yield of 49.88 bushels for that period, as compared with 49.3 bushels for the Winter Turf, 48 bushels for the Winter Turf selection, and 46.95 bushels for the Culberson for the same period.

TABLE X.—*Annual and average yields of varieties and selections of winter oats grown at the Maryland Agricultural Experiment Station (College Park) and at Arlington Farm, Va., for the years stated.*

Group and variety.	C. I. No.	Yield per acre (bushels).							
		1908	1909	1910	1911	1912	1913	1914	Average.
COLLEGE PARK (13 VARIETIES AND SELECTIONS).									
Culberson:									
Culberson	273	42.37	46.75	40.90	50.35	54.37	41.16	48.20	46.30
Bicknell:									
Bicknell	206	.....	65.24	38.90	53.56	47.54	44.92	49.10	49.88
Red Rustproof:									
Red Rustproof	518	26.23	50.51	42.50	55.30	.....	.....	.....	34.91
Appler	339	27.00	.....	.....	.....	.....	.....	.....	.....
Turkish Rustproof:									
Turkish Rustproof	356	37.60	34.17	.....	57.34	40.67	.....	.....	33.96
Winter Turf:									
Winter Turf	180	63.31	33.47	46.70	52.32	66.22	49.00	48.10	51.30
Do	195	.....	45.32	43.90	.....	.....	.....	.....	44.61
Do	203	52.47	34.78	39.10	56.98	22.16	49.21	49.00	43.39
Do	274	43.12	30.79	.....	.....	17.76	.....	.....	30.56
Winter Turf selection	274–1	50.61	38.72	43.60	54.30	47.44	46.63	57.30	48.37
Winter Turf	436	44.57	49.95	46.00	56.86	23.31	.....	.....	44.16
Dun	442	50.37	37.62	.....	.....	.....	.....	.....	44.00
Miscellaneous:									
Boswell Winter	480	31.94	11.49	.....	.....	.....	.....	.....	21.72
ARLINGTON FARM (12 VARIETIES AND SELECTIONS).									
Culberson:									
Culberson	273	.....	.....	.....	40.90	[1] 19.52	[2] 33.50	[3] 54.60	37.14
Culberson selection	273–19	.....	.....	.....	49.40	24.53	31.90	58.50	41.08
Do	273–20	.....	.....	.....	.....	15.00	28.80	.....	21.90
Do	651	.....	.....	.....	42.80	4.75	19.70	49.30	29.14
Do	511–II	.....	.....	.....	48.80	21.50	42.70	.....	37.67
Bicknell:									
Bicknell	206	.....	.....	.....	33.10	4.75	36.60	59.10	33.39
Bicknell selection	206–3	.....	.....	.....	38.80	10.44	49.80	57.60	39.16
Do	206–7	.....	.....	.....	40.00	10.84	46.60	53.50	37.74
Do	206–10	.....	.....	.....	40.00	2.81	.....	53.00	31.94
Red Rustproof:									
Red Rustproof	256	.....	.....	.....	52.50	5.41	49.40	.....	35.77
Red Rustproof selection	518–3	.....	.....	.....	63.10	5.94	43.40	61.90	43.59
Do	518–4	.....	.....	.....	50.00	1.13	.....	.....	25.57
Red Rustproof	548	.....	.....	.....	60.30	6.64	45.50	.....	37.48
Winter Turf:									
Winter Turf selection	274–20	.....	.....	.....	26.30	20.75	46.60	64.40	39.51
Winter Turf	427	.....	.....	.....	36.30	18.75	40.00	67.20	40.56
Do	431	.....	.....	.....	29.40	25.31	40.00	61.90	39.15
Do	435	.....	.....	.....	34.10	24.69	35.90	64.10	39.70
Miscellaneous:									
Selection from Appler [4]	259–11	.....	.....	.....	.....	.....	.....	81.30	.....
Fulghum	708	.....	.....	.....	.....	.....	.....	59.30	.....

[1] Average of 3 check plats.
[2] Average of 5 check plats.
[3] Average of 7 check plats.
[4] Distinct from the original variety.

At Arlington Farm the highest average yield for the four years (1911–1914), 43.59 bushels, was produced by the Red Rustproof selection, C. I. No. 518–3. The Culberson selection, C. I. No. 273–19, has averaged 41.08 bushels for the same period, while the four lots of Winter Turf and the best Bicknell selection (C. I. No. 206–3) are only slightly lower in yield.

LEADING VARIETIES.

Four varieties of winter oats have been of importance at both the the Maryland station and Arlington Farm. These are the Bicknell, Culberson, Red Rustproof, and Winter Turf. Several strains or

selections of each have been grown at Arlington Farm each year except of the Red Rustproof, of which only one selection has been grown during the entire four years. At College Park only one strain of each variety except the Winter Turf has been grown continuously. Of the latter, three strains have been included. The average dates of heading and maturity, height, yields of grain and of straw, and weight per bushel of the more important varieties and selections at the Maryland station and at Arlington Farm are shown in Table XI.

TABLE XI.—*Miscellaneous data for varieties of winter oats grown at the Maryland Agricultural Experiment Station (College Park) and at Arlington Farm, Va., for the years stated.*

Group and variety.	C. I. No.	Number of years grown.	Average date—		Average height.	Average yield per acre.		Average weight per bushel.
			Headed.	Ripe.		Grain.	Straw.	
COLLEGE PARK (6 VARIETIES), 1908 TO 1914, INCLUSIVE.								
					Inches.	*Bushels.*	*Pounds.*	*Pounds.*
Winter Turf:								
Winter Turf	180	7	[1] May 27	[1] June 28	41	51.30	[2] 2,480	[3] 30.4
Winter Turf selection	274–1	7	[1] June 2	[1] ...do...	41	48.37	[2] 2,640	[3] 30.6
Winter Turf	203	7	[1] June 1	[1] ...do...	39	43.39	[3] 2,300	[3] 33.0
Average for group			May 31	[1] ...do...	40.3	47.69	2,470	31.3
Bicknell:								
Bicknell	206	6	[1] May 19	[1] June 18	36	49.88	2,150	[4] 32.3
Culberson:								
Culberson	273	7	[4] May 22	[4] June 20	38	46.30	[2] 2,380	[3] 30.0
Red Rustproof:								
Red Rustproof	518	5	[1] May 21	[1] June 23	[1] 35	34.91	[1] 1,820	[1] 29.7
ARLINGTON FARM (11 VARIETIES AND SELECTIONS), 1911 TO 1914, INCLUSIVE.								
Red Rustproof:								
Red Rustproof selection	518–3		May 20	June 12	33	43.59	2,000	27.3
Winter Turf:								
Winter Turf	427		June 1	June 26	39	40.56	2,610	32.5
Do	435		May 30	June 24	38	39.70	2,680	33.6
Winter Turf selection	274–20		May 31	...do...	38	39.51	2,340	29.5
Winter Turf	431		...do...	June 25	38	39.15	2,680	31.9
Bicknell:								
Bicknell selection	206–3		May 22	June 11	34	39.16	2,250	34.5
Do	206–7		May 24	June 13	34	37.74	1,970	34.6
Bicknell	206		May 22	...do...	34	33.39	2,150	35.1
Culberson:								
Culberson selection	273–19		May 28	June 15	34	41.08	2,330	32.0
Culberson	273		May 27	...do...	34	37.14	2,330	33.0
Culberson selection	651		May 24	June 12	34	29.14	1,970	30.7
Summary of averages for Arlington Farm:								
Red Rustproof			May 20	...do...	33	43.59	2,000	27.3
4 Winter Turf			May 31	June 25	38.3	39.73	2,580	31.9
3 Bicknell			May 23	June 12	34.0	36.76	2,120	34.7
3 Culberson			May 26	June 14	34.0	35.79	2,210	31.9

[1] Data for 3 years only. [2] Data for 6 years only. [3] Data for 5 years only. [4] Data for 4 years only.

The data on the average date of ripening at Arlington Farm (Table XI) show that the Bicknell and Red Rustproof ripen about 2 weeks earlier and the Culberson from 10 days to 2 weeks earlier than the Winter Turf. The data for College Park show less difference among

the varieties, though the Winter Turf is several days later than any of the others. The average height of the Bicknell, Culberson, and Red Rustproof is about the same, 34 inches at Arlington Farm and 35 to 38 inches at College Park. The Winter Turf is about 4 inches taller than the other varieties at both places. The Winter Turf has produced the highest yields of straw and the Bicknell the highest weight per bushel. The Red Rustproof has been lowest both in yield of straw and in weight per bushel.

Descriptions of the more important varieties and selections are given in the following paragraphs. Heads of these varieties are shown in figure 5.

FIG. 5.—Heads of four varieties of winter oats grown at the Maryland Agricultural Experiment Station and at Arlington Farm: 1, Culberson; 2, Bicknell; 3, Winter Turf; 4, Red Rustproof.

Bicknell.—The Bicknell oat, C. I. No. 206, was obtained from Argentina by the United States Department of Agriculture in 1902, through Mr. F. W. Bicknell. The panicles are small and rather dense. The short, buff kernels are usually very plump, so that the weight per bushel is high. This variety is one of the earliest to mature, usually ripening about June 12 to 15. The Bicknell has yielded slightly more than any other variety for the six years it has been grown at College Park, where it has produced quite consistently high yields every year. At Arlington Farm the original variety has averaged 10.2 bushels less and the best selection 4.43 bushels less in a 4-year test than the highest yielding variety in the test, which was a Red

Rustproof selection. The Bicknell was injured more than either the Winter Turf or Culberson by the severe cold in January, 1912. There is little difference in the appearance of the original variety and of the pure-line selections from it which have been grown at Arlington Farm, but in a 4-year test C. I. No. 206–3 has averaged 5.77 bushels and C. I. No. 206–7 4.35 bushels to the acre more than the unselected stock of C. I. No. 206.

Culberson.—The Culberson oat is supposed to have originated as a mass selection from the Red Rustproof, as commercial stocks of that variety usually contain mixtures similar to the Culberson. It grows taller than the Red Rustproof and has larger, more spreading panicles and much smaller kernels. The kernels are decidedly variable in color, ranging from white through brown to grayish black. The strains which bear brown or black kernels do not differ otherwise in appearance from the white-kerneled strains. In commercial stocks of the Culberson at least 90 per cent of the kernels are usually white. The Culberson matures 2 or 3 days later than the Bicknell and Red Rustproof and about 10 days earlier than Winter Turf.

Only the original stock of the Culberson, C. I. No. 273, has been included in the tests at College Park. This variety has been very consistent in yield, ranging from 40.9 to 54.37 bushels during the seven years, with an average of 46.3 bushels. This average yield is lower than that of the Winter Turf and is also lower than that of the Bicknell for the six years during which that variety has been grown. The yield of the Culberson was considerably higher than that of the Red Rustproof for the five years from 1908 to 1912. At Arlington Farm the original stock of the Culberson has produced an average yield of 37.14 bushels in the four years from 1911 to 1914. The average yield of the Culberson at Arlington Farm was from 2 to 3 bushels lower than that of the various strains of the Winter Turf, about 6½ bushels lower than the best Red Rustproof, and 2 bushels lower than the best selection from the Bicknell. The average weight per bushel of the Culberson at Arlington Farm for the four years was 33 pounds, which is higher than that of any other variety except the Bicknell.

Two selections from the Culberson, C. I. No. 273, have been grown for four years at Arlington Farm. These are C. I. Nos. 273–19 and 651. The former is a pure line with brown kernels, which otherwise is not distinguishable in appearance from the original stock. It has exceeded the unselected variety in average yield by nearly 4 bushels. C. I. No. 651 is a selection (No. 5) which was made in 1908 by Prof. C. A. Mooers at the Tennessee Agricultural Experiment Station. It matures about three days earlier than the original Culberson, produces less straw, and has brownish black kernels. It is apparently less hardy than the original stock, as it winterkilled much more in the

severe winter of 1911–12. The average yield for the four years is 8 bushels less than that of C. I. No. 273.

From the records at Arlington Farm and College Park in 1912, the Culberson appears to rank next in hardiness to the Winter Turf. It matures early, produces good yields of grain and straw, and because of its hardiness is apparently one of the best varieties for growing in this locality. This variety makes a heavier growth of straw and leaves than the Bicknell or Red Rustproof and is to be preferred to those varieties for the production of hay.

Red Rustproof.—The Red Rustproof is supposed to have been developed from *Avena sterilis*, a species of wild oat which is native to the countries surrounding the Mediterranean Sea. This variety has been grown for many years in the southern United States. Its origin is not definitely known, though probably it was imported from southern Europe. Numerous names have been applied to the Red Rustproof and selections from it. These names include Texas Red Rustproof, Texas Red, Appler, Bancroft, Cook, Hundred Bushel, and Lawson. Some of the selections probably are superior to the original variety.

The Red Rustproof has stiff, rather short straw, with small, short, branched heads. The kernels are large, are almost always awned, and usually bear basal bristles. The second kernel in the spikelet, which is only slightly smaller than the first, usually bears a weak awn. The awns, basal bristles, and the long points of the lemmas prevent the kernels from packing closely and hence cause the weight per bushel of this variety to be low. They also make it difficult to sow with the grain drill, as the seed does not feed freely. The average weight per bushel at Arlington Farm was 27.3 pounds, as compared with 33 pounds for the Culberson and 33.6 pounds for the best strains of the Winter Turf in the same years. The Red Rustproof ripens at about the same time as the Bicknell and two or three days earlier than the Culberson.

The Red Rustproof is the oat which is most commonly grown from both fall and spring seeding in the Southern States. In the vicinity of Washington, D. C., it is near its northern limit of winter hardiness, as was shown by the low yield produced at Arlington Farm in 1912 and the total failure at College Park that year. In favorable or even in ordinary years the Red Rustproof produces yields as good as or better than those of the Culberson and Winter Turf. In severe winters this variety may be expected to winterkill almost completely.

At College Park the only lot of Red Rustproof which was grown more than one year was C. I. No. 518. This strain produced a low yield in 1908, good yields in 1909, 1910, and 1911, and was a total failure in 1912. It was not grown in 1913 and 1914. At Arlington Farm two unselected lots of the Red Rustproof, C. I. Nos. 256 and 548,

were grown from 1911 to 1913. During these years they produced slightly larger yields than any other varieties included in the tests except the Red Rustproof selection, C. I. No. 518–3. Like most commercial stocks of the Red Rustproof, they contained a considerable mixture of other varieties and hence were discarded after the 1913 crop was harvested. A pure-line selection from the Red Rustproof, C. I. No. 518–3, has been grown from 1911 to 1914, with an average yield of 43.59 bushels to the acre. This average yield is 2½ bushels higher than that of the best Culberson selection and 3 bushels higher than that of the best Winter Turf.

Winter Turf.—The panicles of the Winter Turf oat are medium to large, containing about the same number of kernels as those of the Culberson. The kernels are small to medium in size and grayish white or brownish white in color. The veins on the flowering glumes are distinctly darker than the ground color of the glume, giving a striped appearance to the kernel. In favorable seasons the kernels are plump and the weight per bushel is high. The variety is late in maturing, usually ripening about the end of June in the locality of Washington.

The Winter Turf is commonly grown from fall seeding or from very early spring seeding in the northern half of the Southern States. It does not yield well in the Gulf States. This variety is variously known as Winter Turf, Grazing, Gray Winter, Virginia Winter, Dewey, Snoma, etc. It is the hardiest of all the winter oats, having produced nearly as good yields after the severe winter of 1912 as in ordinary years. This variety is extensively grown for grazing; hence one of the names. Its fall growth is distinctly turflike, somewhat resembling that of winter rye. The Winter Turf stools more freely than other varieties of winter oats and produces a taller and more slender straw. For these reasons it is quite likely to lodge, and this tendency is further increased by its late maturity and consequent exposure to a greater number of storms than the early varieties.

Three lots of the Winter Turf, C. I. Nos. 180, 203, and 274–1, the last a pure-line selection, have been grown for seven years at College Park. Four other strains have been grown from two to five years. C. I. No. 180 produced an average yield of 51.3 bushels in seven years, which is the highest yield recorded at College Park. The next highest yield is 48.37 bushels from the pure-line selection C. I. No. 274–20. At Arlington Farm C. I. Nos. 427, 431, and 435 and the pure-line selection C. I. No. 274–20 have been grown for the four years from 1911 to 1914. These strains have differed little in yield, C. I. No. 427 having produced the highest and C. I. No. 431 the lowest yield, 40.56 and 39.15 bushels, respectively. The Winter Turf varieties have averaged from 3 to 4½ bushels less than the best Red Rustproof selection and from one-half bushel to 2 bushels less than the best Culberson selection.

The Winter Turf, because of its hardiness, is the most dependable variety for the vicinity of Washington, D. C. Its late maturity and its tendency to lodge, however, make it rather less desirable than the Culberson, Bicknell, and Red Rustproof. It matures at about the same time as wheat, while the other varieties may be harvested before the wheat crop is ripe. Where winter wheat is grown on the same farm, the earlier varieties are to be preferred. As they are less hardy, they must be sown earlier than is necessary for the Winter Turf.

EXPERIMENTS WITH WINTER BARLEY.

Varietal tests of winter barley have been conducted at College Park since 1907 and at Arlington Farm since 1908. The tests at the former place have included 12 varieties, of which only four have been continued for the entire seven years (1908 to 1914). At Arlington Farm 56 varieties and strains have been grown from one to six years, most of them for short periods only.

The dates of seeding at College Park during the past seven years were as follows: October 17, 1907; October 9, 1908; September 29, 1909; September 21, 1910; September 20, 1911; October 1, 1912; and October 4, 1913, the average date being about October 2. The dates of seeding at Arlington Farm were September 29, 1908; September 21, 1909; September 15, 1910; September 10, 1911; September 16, 1912; and October 6, 1913, the average being about September 21, or 11 days earlier than for College Park. Experience has shown that the date of seeding this crop at Arlington Farm has been too early in most years for the best results. On the other hand, the crop occasionally has been sown too late at College Park. While no definite rule can be formulated, it is believed that sowing between September 25 and October 5 will give the best results under average conditions.

TABLE XII.—*Annual and average yields of varieties of winter barley grown at the Maryland Agricultural Experiment Station (College Park) and at Arlington Farm, Va., for the years stated.*

Group and variety.	C. I. No.	Yield per acre (bushels).							
		1908	1909	1910	1911	1912	1913	1914	Average.
COLLEGE PARK (12 VARIETIES).									
Six-rowed hulled:									
Maryland Winter	518	32.85	36.72	24.70	31.87	42.03	32.13	37.50	33.97
Mammoth Winter	410	23.53	34.71	20.10	32.96	47.38	35.17	39.60	33.35
Tennessee Winter	257	39.79	29.84	20.70	32.79	42.58	31.83	35.80	33.33
Winter 6-rowed	328	24.73	27.58	22.80	36.36	33.91	24.92	35.40	29.39
Arlington (Arlington Awnless)	702						16.42	17.60	17.01
Squarehead Winter	252	29.72	35.20						32.46
Tenarab	662	24.07	30.41						27.24
Dutrow Winter [1]			32.80	22.60					27.70
Han River	206	28.51							
Black Winter	337	25.39							
Albacete	199	21.62							
Greece	221	17.77							

[1] A variety commonly grown in Frederick County, Md.

TABLE XII.—*Annual and average yields of varieties of winter barley grown at the Maryland Agricultural Experiment Station (College Park) and at Arlington Farm, Va., for the years stated*—Continued.

Group and variety.	C. I. No.	Yield per acre (bushels).							
		1908	1909	1910	1911	1912	1913	1914	Average.
ARLINGTON FARM (56 VARIETIES AND STRAINS).									
Six-rowed hulled:									
Tennessee Winter	257	.....	41.70	23.40	15.00	35.33	[1] 21.70	[2] 30.70	27.97
Wisconsin Winter	519	.....	45.00	14.27	15.40	25.52	31.40	53.50	27.52
Maryland Winter	518	.....	39.70	[3] 27.31	(4)	(4)	21.50	24.20	28.10
Texas Winter	554	.....	.....	28.64	22.80	26.25	22.50	22.80	24.60
Virginia (Virginia Hooded) [5]	648	.....	.....	45.81	13.40	0	28.40	19.40	21.40
Large-grained Winter	408	.....	.....	21.25	(4)	(4)	30.40	31.30	27.65
Hybrid [6]	896	.....	.....	.....	17.30	38.04	28.10	26.30	27.44
Do. [6]	895	.....	.....	.....	18.90	30.47	28.80	29.20	26.84
Canada Winter	713	.....	.....	.....	16.00	29.29	25.00	28.50	24.70
Tenkau [7]	646	.....	.....	.....	13.30	.....	39.60	32.10	28.33
Squarehead Winter	252	.....	.....	.....	.....	24.17	30.80	27.70	27.56
Tanbash	578	.....	.....	.....	.....	.....	27.90	25.80	26.85
Argentine	223	.....	.....	.....	(4)	18.23	16.70	33.30	22.74
Arlington (Arlington Awnless) [5]	702	.....	.....	.....	.....	20.52	17.50	22.30	20.11
Scottish Pearl	277	.....	.....	.....	.....	.....	36.00	32.30	34.15
Mammoth Winter	220	.....	.....	(4)	(4)	.....	.....	23.50	.....
Odessa	182	.....	.....	17.50	(4)	.....	28.50	.....	23.00
Telli	194	.....	.....	22.50	(4)	(4)	31.50	.....	27.00
Gatami	575	.....	.....	16.46	15.20	0	.....	.....	15.83
Albacete	199	.....	.....	15.41	12.30	.....	24.20	.....	17.30
Bestehorn Giant	414	.....	.....	19.60	(4)	51.42	10.00	.....	27.01
Turkestan	712	.....	.....	.....	3.30	2.79	4.20	.....	3.43
Manchuria	613	.....	.....	25.20	16.00	.....	.....	.....	20.60
Caveda	455	.....	.....	.....	.....	23.58	9.20	.....	16.39
Han River	206	.....	.....	.....	(4)	2.92	.....	.....	.....
Greece	221	.....	.....	34.06	(4)	.....	.....	.....	.....
Alaska	534	.....	.....	.....	(4)	.....	27.50	.....	.....
Blue Ribbon	611	.....	.....	.....	(4)	.....	26.00	.....	.....
Union Winter	583	.....	.....	.....	.....	.....	.....	27.09	.....
Hybrid [7]	901	.....	.....	.....	.....	.....	.....	32.50	.....
Do. [7]	902	.....	.....	.....	.....	.....	.....	24.80	.....
Two-rowed hulled:									
Svanhals	187	.....	.....	20.83	8.30	15.67	25.30	25.80	19.18
Nesbian [6]	647	.....	.....	.....	15.90	12.33	24.00	24.80	19.26
Omar [6]	898	.....	.....	.....	.....	.....	25.00	25.60	25.30
Hanna	287	.....	.....	26.66	14.80	11.83	18.80	.....	18.02
Pedigree Chevalier	156	.....	.....	14.58	36.90	7.17	14.60	.....	18.31
Black Arabian	202	.....	.....	.....	11.70	37.92	18.50	.....	22.71
Hanna	203	.....	.....	.....	6.30	6.25	18.10	.....	10.22
Princess	529	.....	.....	23.33	8.30	0	.....	.....	10.54
White Smyrna	195	.....	.....	.....	.....	36.67	8.80	.....	22.74
Hannchen	531	.....	.....	.....	40.80	0	.....	.....	20.40
Bavarian	160	.....	.....	.....	30.00	0	.....	.....	15.00
Do	159	.....	.....	.....	41.00	0	.....	.....	20.50
Princess	193	.....	.....	14.79	27.10	0	.....	.....	13.96
Chevalier II	200	.....	.....	.....	5.40	0	.....	.....	2.70
Prize Prolific	169	.....	.....	.....	9.20	0	.....	.....	4.60
Chevalier	612	.....	.....	15.00	19.20	.....	.....	.....	17.10
Black Smyrna	191	.....	.....	.....	13.10	.....	28.30	.....	20.70
Orel	351	.....	.....	.....	13.40	0	.....	.....	17.70
White Smyrna	530	.....	.....	.....	.....	31.88	22.00	.....	26.94
Naked: [8]									
Hansee [7]	703	.....	.....	.....	24.00	20.58	11.30	27.30	20.80
Sangatsuka	78	.....	.....	.....	21.30	7.83	19.00	.....	16.04
Hankau	197	.....	.....	.....	20.50	7.63	.....	.....	14.07
Black Hull-less	618	.....	.....	.....	13.70	0	.....	.....	6.85
Kamamugi	577	.....	.....	.....	17.00	.....	.....	.....	.....
Wakamatsu	579	.....	.....	.....	13.70	.....	.....	.....	.....

[1] Average yield of 7 check plats.
[2] Average yield of 9 check plats.
[3] Average yield of 6 check plats.
[4] Yields not comparable, due to pronounced soil variation.
[5] Selection from the cross, Tennessee Winter (C. I. No. 257), a 6-rowed bearded hulled winter barley, × Success (C. I. No. 507), a 6-rowed hooded hulled spring barley.
[6] Selection from the cross, Tennessee Winter (C. I. No. 257) × Black Arabian (C. I. No. 202), a 2-rowed bearded hulled spring barley.
[7] Selection from the cross, Tennessee Winter (C. I. No. 257) × Hankau (C. I. No. 197), a 6-rowed bearded naked spring barley.
[8] The yields of these varieties were calculated at 60 pounds per bushel. All are 6-rowed awned varieties.

The rate of seeding at College Park has been 8 pecks for all years except 1909 and 1911, when the rates were 10½ and 11 pecks, respectively. At Arlington Farm the hulled varieties have been sown uniformly at the rate of 8 pecks, which appears to be about the best rate. The naked barleys have been sown at the rate of 6 pecks in all years except 1911, when 8 pecks were sown.

The annual and average yields per acre of the varieties tested at College Park during the seven years from 1908 to 1914, inclusive, and

FIG. 6.—Heads of three varieties of winter barley grown at Arlington Farm: 1, Tennessee Winter; 2, Wisconsin Winter; 3, Omar.

at Arlington Farm during the six years from 1909 to 1914, inclusive, are shown in Table XII.

All the varieties included in the tests at College Park, as shown in Table XII, belong to the 6-rowed hulled group, all except the Arlington being quite similar to the Tennessee Winter (fig. 6) and Maryland Winter varieties (C. I. Nos. 257 and 518, respectively). Of the 56 varieties and strains included in the tests at Arlington Farm (Table XII), 31 belong to the 6-rowed hulled group, 19 to the 2-rowed hulled, and 6 to the naked or hull-less group. Most of these varieties are bearded.

The varieties of the 6-rowed hulled group usually have produced the best yields. All the 2-rowed barleys with the exception of the

two hybrids, Nesbian and Omar, are spring varieties that have been grown from fall seeding. In 1911 several of these 2-rowed spring barleys outyielded the best 6-rowed winter barleys, but the following year more than half of them were completely winterkilled during the severe weather in January. It is doubtful whether any of the 2-rowed spring varieties can be grown successfully from fall seeding during a series of years.

The yields obtained from the naked barleys also are unsatisfactory. The yields of these varieties shown in Table XII are calculated at 60 pounds to the bushel, the standard weight for this group.

The average dates of heading and of maturity, height, yield of grain and of straw, and weight per bushel of the four leading varieties of barley at College Park for the seven years from 1908 to 1914 are shown in Table XIII. The same data for 16 of the more important varieties and strains grown at Arlington Farm for periods ranging from two to six years are also given.

TABLE XIII.—*Miscellaneous data for varieties of winter barley grown at the Maryland Agricultural Experiment Station (College Park) and at Arlington Farm, Va., for the years stated.*

Variety.	C. I. No.	Number of years grown.	Average date—		Average height.	Average yield per acre.		Average weight per bushel.
			Headed.[1]	Ripe.[1]		Grain.	Straw.[2]	
COLLEGE PARK (4 LEADING VARIETIES), 1908 TO 1914, INCLUSIVE.					*Inches.*	*Bush.*	*Lbs.*	*Lbs.*
Maryland Winter	518	7	May 8	June 10	34	33.97	2,050	[3] 40.4
Mammoth Winter	410	7	...do...	...do...	34	33.35	2,200	[4] 43.0
Tennessee Winter	257	7	...do...	...do...	33	33.33	2,140	[1] 39.7
Winter 6-rowed	328	7	May 11	June 12	34	29.39	1,880	[4] 42.5
ARLINGTON FARM (16 VARIETIES AND STRAINS), 1909 TO 1914, INCLUSIVE.								
Six-rowed hulled:								
Tennessee Winter	257	6	May 6	June 3	[2] 33	27.97	[3] 2,230	43.3
Wisconsin Winter	519	6	May 8	June 6	[2] 34	27.52	[3] 2,540	43.6
Maryland Winter	518	6	May 7	June 3	30	[3] 28.10	[5] 2,050	43.8
Texas Winter	554	5	...do...	June 4	30	24.60	[3] 2,059	44.7
Virginia (Virginia Hooded)	648	5	Apr. 26	May 30	34	21.40	[5] 1,970	[3] 38.8
Large-grained Winter	408	4	May 17	June 14	31	[4] 27.65	[6] 3,230	45.6
Hybrid	896	4	May 9	June 2	34	27.44	2,030	41.6
Do	895	4	May 10	...do...	33	26.84	1,800	40.5
Canada Winter	713	4	...do...	June 3	35	24.70	1,980	42.5
Tenkau	646	3	...do...	June 4	35	28.33	2,650	43.3
Squarehead Winter	252	3	May 11	June 6	30	27.56	2,570	44.0
Arlington (Arlington Awnless)	702	3	Apr. 26	May 26	37	20.11	1,330	49.3
Two-rowed hulled:								
Svanhals	187	5	May 6	June 5	33	19.18	[3] 1,840	48.1
Nesbian	647	4	May. 8	June 4	33	19.26	[4] 2,260	47.8
Omar	898	2	May 11	June 6	37	25.30	2,690	47.5
Naked:								
Hansee	703	4	May 1	May 31	33	20.80	2,570	60.5

[1] Data for 6 years only.
[2] Data for 5 years only.
[3] Data for 4 years only.
[4] Data for 3 years only.
[5] Data for 2 years only.
[6] Data for 1 year only.

Table XIII shows that the more important varieties have ripened about June 10 at College Park and from June 3 to 6 at Arlington Farm. The earliest varieties at Arlington Farm are the three hybrids, Arling-

ton, Virginia, and Hansee. At College Park the varieties have averaged about 34 inches in height. At Arlington Farm the range has been from 30 to 37 inches, with the more important varieties averaging about 34 inches. The yields of straw have averaged about 1 ton to the acre, or rather less than was obtained from oats during the same years. The weight per measured bushel of nearly all varieties is considerably below the standard weight at both College Park and Arlington Farm. The Arlington is the only 6-rowed hulled variety which has averaged more than 48 pounds to the bushel. The 2-rowed varieties averaged almost exactly the standard weight per bushel.

LEADING VARIETIES.

The leading varieties of barley at College Park and Arlington Farm all belong to the 6-rowed bearded hulled group. Two varieties of the 2-rowed bearded hulled group and one of the naked group, however, are of some interest. Brief descriptions of the more important varieties are included in the paragraphs which follow.

THE 6-ROWED HULLED GROUP.

The greater part of the varieties in the 6-rowed hulled group which have been tested at College Park and Arlington Farm are true winter forms. About one-fourth of the varieties which have been grown at Arlington Farm, however, are really spring forms which have been sown in the fall. For the most part these varieties are fairly winter hardy, but they still retain the erect early growth and other characteristics of the spring forms. The most important 6-rowed winter barley is the Tennessee Winter. Other varieties of special interest are the Wisconsin Winter, the Arlington, and the Virginia.

Tennessee Winter.—A 6-rowed bearded hulled winter barley has been grown for many years in the South Atlantic and Gulf States. This variety was improved by mass selection at the Tennessee Agricultural Experiment Station. It was first distributed from that station about 1900, when it was given the name "Tennessee Winter." At College Park the Tennessee Winter, C. I. No. 257, produced an average yield of 33.33 bushels during the seven years from 1908 to 1914. This is slightly less than has been produced by the very similar variety, Maryland Winter, C. I. No. 518. At Arlington Farm the Tennessee Winter has produced an average yield of 27.97 bushels in the six years from 1909 to 1914. Only one other variety, the Wisconsin Winter, C. I. No. 519, has been grown on comparable land during the entire six years. The yield of Wisconsin Winter was 0.45 bushel less than that of Tennessee Winter.

The average date of maturity of the Tennessee Winter at Arlington Farm is June 3 and at College Park June 10. The average height of the plants was 33 inches. The average yield of straw was slightly

more than 1 ton. The average weight per bushel of the variety for six years at Arlington Farm was 43.3 pounds.

Numerous other varieties which have been included in the tests are practically identical with the Tennessee Winter in appearance, hardiness, and yield. Among these are the Maryland Winter, C. I. No. 518; Texas Winter, C. I. No. 554; Union Winter, C. I. No. 583; and Canada Winter, C. I. No. 713. Two selections from the cross between the Tennessee Winter and the Black Arabian, C. I. Nos. 895 and 896, are also much like the Tennessee Winter. They have been among the best yielders during the four years they have been grown. The Tennessee Winter and similar varieties seem to be better adapted for fall seeding in the locality of Washington, D. C., than any of the other winter barleys.

Wisconsin Winter.—The Wisconsin Winter barley, C. I. No. 519, appears to be a winter variety from a region of mild winters. It is winter hardy in the vicinity of Washington, but the plants make a more vigorous top growth in the fall than those of the Tennessee Winter and similar varieties, while the leaves are much wider and the winter habit is less pronounced. The yield of the Wisconsin Winter at Arlington Farm during the six years from 1909 to 1914 was 27.52 bushels, which is 0.45 bushel less than that of the Tennessee Winter for the same period. The average date of maturity for the variety is three days later than that of the Tennessee Winter.

Arlington.—The Arlington (Arlington Awnless) barley, C. I. No. 702, is a 6-rowed awnless hulled barley which was developed by selection from a hybrid between the Tennessee Winter and the Black Arabian, the latter being a 2-rowed bearded hulled variety. This selection was continued through several years by Mr. H. B. Derr, formerly of the Office of Cereal Investigations.[1] It is the earliest variety included in the tests, ripening about May 26. Because of its awnless character and its earliness it was expected that the Arlington would become a very important winter variety, as it appeared to be nearly as hardy as the Tennessee Winter. The data on yield contained in Table XII, however, show that the Arlington is much inferior to the Tennessee Winter and similar varieties. In the three years from 1912 to 1914 at Arlington Farm the Arlington averaged 20.11 and the Tennessee Winter 29.24 bushels. The heads of the Arlington are very brittle, so that a considerable part of the grain is lost by shattering in harvesting and subsequent handling before thrashing. For these reasons it is doubtful whether the Arlington will become of much importance.

Virginia.—The name Virginia (Virginia Hooded), C. I. No. 648, was applied by Mr. H. B. Derr to a hooded selection from a hybrid between the Tennessee Winter and the Success, a 6-rowed hooded hulled spring barley. It was hoped that this variety would prove to

[1] Derr, H. B. A new awnless barley. *In* Science, n. s., v. 32, no. 823, p. 473–474, 1 fig., 1910.

be winter hardy and that it would be a valuable addition to the list of winter barleys, as its freedom from beards makes it much more pleasant to handle than the ordinary winter varieties. It entirely winterkilled, however, in January, 1912, and was rather badly injured in one or two other years. Its average yield for the five years from 1910 to 1914 at Arlington Farm is 21.4 bushels, which is about 3 bushels less than that of the Tennessee Winter, Texas Winter, and similar varieties for the same period. This variety matures about four days earlier than the Tennessee Winter. The yield of straw is rather less than from the bearded winter varieties. The grain has been light and chaffy, averaging only 38.8 pounds to the bushel, as compared with 43.3 pounds for the Tennessee Winter.

THE 2-ROWED HULLED GROUP.

Most varieties of the 2-rowed group which have been grown at Arlington Farm were originally spring barleys which have been sown in the fall. They have not proved to be winter hardy in years when low temperatures are recorded, though in favorable years they have produced very high yields. They are not sufficiently dependable to make them worthy of recommendation.

Two selections from a hybrid between the Tennessee Winter and the Black Arabian, however, appear to be quite hardy and worthy of further test. These are the Nesbian, C. I. No. 647, and the Omar, C. I. No. 898. It is probable that the latter is the better of the two selections, though it has not been tested long enough to determine its value fully. These hybrids mature a day or two later than the Tennessee Winter. In the tests so far conducted they have not been high in yield. The average yield of the Omar for the two years in which it has been tested is 25.3 bushels, as compared with 26.2 bushels for the Tennessee Winter and 32.45 bushels for the Wisconsin Winter in the same years. The quality of the grain produced by these 2-rowed varieties is much better than that of the 6-rowed barleys, the average weight per bushel being practically 48 pounds.

THE NAKED GROUP.

None of the varieties in the naked group have produced yields nearly as high as those of the 6-rowed hulled varieties. The best naked barley which has been included in the test is a selection from a hybrid which has been called Hansee, C. I. No. 703. This selection was made by Mr. H. B. Derr from a cross between the Tennessee Winter and the Hankau, C. I. No. 197, the latter a 6-rowed bearded naked variety. The Hansee is also a 6-rowed bearded barley. While it is apparently not a true winter variety, it is much more hardy than any of the other naked barleys which have been tested. Its average yield for the four years it has been grown at Arlington Farm is 20.8

bushels of 60 pounds each. This is equivalent to about 26 bushels of hulled barley. The Hansee matures about three days earlier than the Tennessee Winter.

EXPERIMENTS WITH SPRING-SOWN GRAINS.

Several attempts have been made to grow spring wheat, oats, and barley at Arlington Farm, but with little or no success. Of the three, the best yields have been obtained from spring oats. The yields, however, were much lower than from fall-sown oats, and the crop is much more uncertain. No profitable yields of spring barley and spring wheat have been produced in these experiments. Each time that spring wheat has been grown rust has practically destroyed the crop.

A few varieties of buckwheat have been tested, but with very unsatisfactory results. This crop is not well adapted to the warmer portions of the humid area. The highest yield obtained with buckwheat at Arlington Farm was about 10 bushels per acre.

The prosos (broom-corn millets) also have been tested as a grain crop, but without success. Of 10 varieties grown at Arlington Farm in 1911 and 1912, not one produced anything approaching a satisfactory yield. Proso is not of value as a grain crop in the humid portions of the United States.

The few tests which have been made of grain sorghum indicate that this crop does fairly well at Arlington Farm. However, it is not a profitable crop where corn can be grown successfully, and there is no reason to grow any of the various forms in this locality.

SUMMARY.

Experiments with cereals have been conducted since 1907 at College Park, Md. (in cooperation with the Maryland Agricultural Experiment Station), and at Arlington Farm, Va. The results of varietal tests of the different winter cereals are reported in this bulletin.

The average annual rainfall for the ten 12-month periods from July 1, 1904, to June 30, 1914, inclusive, at Washington, D. C., was 42.33 inches. The average annual rainfall at College Park is about 4 inches less than at Washington.

The size of the plats on which the varietal tests were conducted was in most cases one-twentieth of an acre.

The varietal tests at College Park have included 107 varieties and races of wheat, 5 of spelt, 3 of emmer, 13 of oats, and 12 of barley. At Arlington Farm the tests have included 43 varieties and races of winter wheat, 12 of rye, 4 of spelt, 2 of emmer, 19 of oats, and 56 of barley. Only winter varieties of the various cereals are adapted.

Of the 43 winter wheats tested at Arlington Farm, 11 are selections from hybrids which have been developed at College Park and Arlington Farm. The most promising of these hybrids is the Virginia, C. I. No. 3277.

The five leading varieties of wheat at College Park, with the 7-year average yield of each in bushels per acre, are as follows: China, 31.17 bushels; Mammoth Red, 31.09 bushels; Bearded Purple Straw, 30.95 bushels; Turkish Amber, 30.11 bushels; and Lancaster, 30.03 bushels.

The five leading varieties of winter wheat at Arlington Farm, with the 5-year average yield of each in bushels per acre, are as follows: Purple Straw (C. I. No. 1915), 32.09 bushels; Lancaster, 29.74 bushels; Dawson Golden Chaff, 29.37 bushels; Fultz, 29.17 bushels; and Purple Straw (C. I. No. 1957), 29.17 bushels.

A rate-of-seeding test with several varieties of winter wheat at Arlington Farm indicates that better yields may be obtained on well-prepared land from sowing 3 or 4 pecks than from heavier rates of seeding.

Several varieties of winter spelt and one of emmer have been tested. The best variety of winter spelt, the Alstroum, has a 6-year average yield at College Park of 63.23 bushels and a 5-year average yield at Arlington Farm of 74.08 bushels. The Black Winter emmer has averaged 36.57 and 22.33 bushels, respectively, for the same periods at College Park and Arlington Farm.

A varietal test of rye has been conducted at Arlington Farm only. Of the 12 varieties and selections tested, the Giant Winter, Virginia Winter, and Abruzzes are the leading varieties. The average yield of Giant Winter rye in a 4-year test was 32.89 bushels. Earlier seeding than is commonly practiced by the average farmer has given very satisfactory results with this crop.

The leading varieties of winter oats at College Park are the Winter Turf, Bicknell, and Culberson, in the order named. The most promising at Arlington Farm are the Red Rustproof, Winter Turf, Bicknell, and Culberson.

The Winter Turf is the hardiest and most dependable variety, but its late maturity and tendency to lodge are objectionable. The Culberson and Bicknell mature ten days to two weeks earlier than the Winter Turf and are to be preferred to it in eastern and southern Maryland and eastern Virginia.

The leading varieties of winter barley at College Park are the Maryland Winter, Mammoth Winter, and Tennessee Winter. These varieties are practically identical. Of the varieties tested at Arlington the Tennessee Winter, Wisconsin Winter, Maryland Winter, and Texas Winter yielded best.

None of the eighteen 2-rowed spring barleys that have been grown from fall seeding at Arlington Farm have been satisfactory. A hybrid

2-rowed winter barley has been developed, which produced an average yield of 25.30 bushels in 1913 and 1914. None of the naked barleys has given satisfactory yields.

Satisfactory results have not been obtained with spring-sown grains at Arlington. None is reliable enough to be recommended.

Winter wheat, spelt, rye, barley, and oats have all given very satisfactory yields. The feed grains, oats, barley, and spelt, should be more generally grown. The varieties most strongly recommended for eastern and southern Maryland and eastern Virginia are as follows:

Winter wheat:
- China.
- Fulcaster.
- Dietz.
- Fultz.
- Purple Straw.
- Bearded Winter Fife.
- Bearded Purple Straw.

Winter spelt:
- Alstroum.

Winter rye:
- Giant Winter.
- Virginia Winter.
- Abruzzes.

Winter oats:
- Winter Turf.

Winter oats—Continued.
- Culberson.
- Bicknell.
- Red Rustproof.

Winter barley:
- Tennessee Winter.
- Wisconsin Winter.

PUBLICATIONS OF THE UNITED STATES DEPARTMENT OF AGRICULTURE RELATING TO CEREALS.

AVAILABLE FOR FREE DISTRIBUTION.

Sealed Paper Carton to Protect Cereals from Insect Attack. (Department Bulletin 15.)
Cereal Investigations at Nephi Substation. (Department Bulletin 30.)
Cereal Investigations on the Belle Fourche Experiment Farm. (Department Bulletin 297.)
Dry-land Grains in Great Basin. (Bureau of Plant Industry Circular 61.)
Winter Wheat in Western South Dakota. (Bureau of Plant Industry Circular 79.)
Cereal Breakfast Foods. (Farmers' Bulletin 249.)
Corn Cultivation. (Farmers' Bulletin 414.)
Rice Culture. (Farmers' Bulletin 417.)
Oats: Distribution and Uses. (Farmers' Bulletin 420.)
Barley Culture in Southern States. (Farmers' Bulletin 427.)
Barley: Growing the Crop. (Farmers' Bulletin 443.)
Durum Wheat. (Farmers' Bulletin 534.)
The Culture of Rice in California. (Farmers' Bulletin 688.)

FOR SALE BY THE SUPERINTENDENT OF DOCUMENTS.

Improvement of Wheat Crop in California. (Bureau of Plant Industry Bulletin 178.) Price, 10 cents.
Cooperative Grain Investigations at McPherson, Kansas, 1904–1909. (Bureau of Plant Industry Bulletin 240.) Price, 5 cents.
Contributions to Study of Maize Deterioration. (Bureau of Plant Industry Bulletin 270.) Price, 10 cents.
Cereal Experiments in Texas Panhandle. (Bureau of Plant Industry Bulletin 283.) Price, 10 cents.
Dry-land Grains for North and South Dakota. (Bureau of Plant Industry Circular 59.) Price, 5 cents.
Methods for Determination of Specific Gravity of Wheat and Other Cereals. (Bureau of Plant Industry Circular 99.) Price, 5 cents.
Course in Cereal Foods and Their Preparation for Movable Schools of Agriculture. (Office of Experiment Stations Bulletin 200.) Price, 10 cents.
Experiments with Wheat, Oats, and Barley in South Dakota. (Department Bulletin 39.) Price, 10 cents.
Wireworms Attacking Cereal and Forage Crops. (Department Bulletin 156.) Price, 5 cents.

ADDITIONAL COPIES

OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.
AT
10 CENTS PER COPY

▽